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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

**CERTIFICATE OF EXPRESS MAILING**

Hereby certify that this paper and the documents and/or fees referred to as attached therein are being deposited with the United States Postal Service on November 21, 2000 in an envelope as "Express Mail Post Office to Addressee" service under 37 CFR §1.10, Mailing Label Number EL711139035US, addressed to the Assistant Commissioner for Patents, Washington, DC 20231.

Attorney Docket No.: CYTOP007C2

First Named Inventor: Vaisberg et al.

*Torrance Stratten*  
Torrance Stratten

**UTILITY PATENT APPLICATION TRANSMITTAL (37 CFR. § 1.53(b))**  
(Continuation, Divisional or Continuation-in-part application)

Assistant Commissioner for Patents  
Box Patent Application  
Washington, DC 20231

Sir: This is a request for filing a patent application under 37 CFR. § 1.53(b) in the name of inventors:  
**Eugeni A. Vaisberg, Cynthia L. Adams, James H. Sabry, Anne M. Crompton**

For: **DATABASE SYSTEM INCLUDING COMPUTER FOR PREDICTIVE CELLULAR BIOINFORMATICS**

This application is a ☒ Continuation ☐ Divisional ☐ Continuation-in-part  
of prior Application No.: 09/311,996, from which priority under 35 U.S.C. §120 is claimed.

**Application Elements:**

- ☒ 53 Pages of Specification, Claims and Abstract  
☒ 24 Sheets of informal Drawings  
☒ Declaration and Power of Attorney  
☐ Newly executed  
☒ Copy from a prior application (37 CFR 1.63(d) for a continuation or divisional).  
The entire disclosure of the prior application from which a copy of the declaration is herein supplied is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.  
☐ Deletion of inventors Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).

**Accompanying Application Parts:**

☐ Assignment and Assignment Recordation Cover Sheet (recording fee of \$40.00 enclosed)

- ☐ Power of Attorney  
☐ 37CFR 3.73(b) Statement by Assignee  
☒ Information Disclosure Statement with Form PTO-1449 ☐ Copies of IDS Citations  
☐ Preliminary Amendment (*New claims numbered after highest original claim in prior application.*)  
☒ Return Receipt Postcard  
☒ Other: Appendix A  
☒ Other: Associate Power of Attorney and Change of Correspondence Address in Application

Claim For Foreign Priority

- ☐ Priority of Application No. filed on  
is claimed under 35 U.S.C. § 119.  
☐ The certified copy has been filed in prior application U.S. Application No.  
☐ The certified copy will follow.

Extension of Time for Prior Pending Application

- ☐ A Petition for Extension of Time is being concurrently filed in the prior pending application. A copy of the Petition for Extension of Time is attached.

Amendments

- ☒ Amend the specification by inserting before the first line the sentence: "This is a  
☒ Continuation ☐ Continuation-in-part ☐ Divisional  
application of co-pending prior  
☒ Application No. 09/311,996 filed on May 14, 1999,  
☐ International Application filed on which  
designated the United States,  
the disclosure of which is incorporated herein by reference."
- ☐ Cancel in this application original claims of the prior application  
before calculating the filing fee. (*At least one original independent claim must be retained.*)

Fee Calculation (37 CFR § 1.16)

☒ Applicant is entitled to Small Entity Status under 37 C.F.R. §1.27.

	(Col. 1) Total Claims		(Col. 2) Claims	(Col. 3) Present Extra	Rate	Additional Fee
TOTAL	48	MINUS	20	= 28	x 18	504.00
INDEP.	4	MINUS	3	= 1	x 80	80.00
[ ] First presentation of multiple dependent claim					\$270	
Basic Filing Fee under 37 C.F.R. §1.16(a)					\$710	710.00
TOTAL						1294.00
SMALL ENTITY 50% FILING FEE REDUCTION (if applicable)						647.00

☒ Check No. \_\_\_\_\_ in the amount of \$647.00 is enclosed.

☒ The Commissioner is authorized to charge any fees beyond the amount enclosed which may be required, or to credit any overpayment, to Deposit Account No. 500388 (Order No. CYTOP007C2).

General Authorization for Petition for Extension of Time (37 CFR §1.136)

☒ Applicants hereby make and generally authorize any Petitions for Extensions of Time as may be needed for any subsequent filings. The Commissioner is also authorized to charge any extension fees under 37 CFR §1.17 as may be needed to Deposit Account No. 500388 (Order No. CYTOP007C2).

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Date: 11/21/00

Jeffrey K. Weaver  
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**PATENT APPLICATION**  
**A DATABASE SYSTEM INCLUDING COMPUTER CODE FOR**  
**PREDICTIVE CELLULAR BIOINFORMATICS**

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# A DATABASE SYSTEM INCLUDING COMPUTER CODE FOR PREDICTIVE CELLULAR BIOINFORMATICS

## CROSS-REFERENCES TO RELATED APPLICATIONS

5           The following commonly-owned co-pending applications, including this one, are being filed concurrently and the others are hereby incorporated by reference in their entirety for all purposes:

1. U.S. Patent Application Serial No. \_\_\_\_\_, James H. Sabry, et al., titled, "A DATABASE METHOD FOR PREDICTIVE CELLULAR  
10 BIOINFORMATICS," (Attorney Docket Number 19681-000100US);

2. U.S. Patent Application Serial No. \_\_\_\_\_, James H. Sabry, et al., titled, "A DATABASE SYSTEM FOR PREDICTIVE CELLULAR  
BIOINFORMATICS," (Attorney Docket Number 19681-000200US);

3. U.S. Patent Application Serial No. \_\_\_\_\_, Cynthia L. Adams,  
15 et. al., titled, "A DATABASE SYSTEM AND USER INTERFACE FOR PREDICTIVE CELLULAR BIOINFORMATICS," (Attorney Docket Number 19681-000300US); and

4. U.S. Patent Application Serial No. \_\_\_\_\_, Eugeni A. Vaisberg, et al., titled, "A DATABASE SYSTEM INCLUDING COMPUTER CODE  
FOR PREDICTIVE CELLULAR BIOINFORMATICS," (Attorney Docket Number  
20 19681-000400US)

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## BACKGROUND OF THE INVENTION

30           The present invention provides information technology based techniques including computer software in therapeutics or drug discovery. In an exemplary embodiment, the present invention provides software for determining information about properties of substances based upon information about structures of living, fixed or non-

living cells, or cell fractions. Computer code according to the present invention enable researchers and scientists to identify promising candidates in the search for new and better medicines and medical techniques.

For a long time, researchers in the pharmaceutical field have sought for better ways of searching for substances possessing properties which make them suitable as medicines. In the early days, researches generally relied upon dyes, or extracts from plants, , or microbiological broths for such substances. Examples of such substances include aspirin, and antibiotics.

Substances having desirable bio-active properties, however, are often difficult to isolate and identify. Advances in organic chemistry such as rapid chemical synthesis techniques have increased the number of compounds that researchers want to test for biological activity. Conventionally, substances were often tested on humans or animal subjects to determine biological activity. While results from such tests can be highly predictive, these types of tests can be time consuming, limiting the progress of the testing.

There have been some attempts to use image acquisition techniques to screen for large numbers of molecules based upon cell information. Conventional image acquisition systems exist that generally capture digitized images of discrete cells for identification purposes. Identification often occurs during the image capturing step, which is limiting. In most cases, these conventional techniques cannot comprehensively provide for complete cellular information but can only be used to identify a fairly limited set of information.

What is needed are techniques for collecting and managing information useful in finding the effects of manipulations on cell function, response or behavior.

## SUMMARY OF THE INVENTION

According to the present invention, techniques for using information technology in therapeutics or drug discovery. In an exemplary embodiment, computer software for determining information about the properties of substances based upon information about a structure or the morphology of living, fixed or dead cells (e.g., elements, cell portions and cell fractions) exposed to substances are provided. Computer software according to the present invention enables researchers and/or scientists to

identify promising candidates in the search for new and better medicines or treatments using, for example, a cellular informatics database.

According to the present invention, a computer program for identification and verification of biological properties of substances can include code that administers a  
5 sample of the substance to a cell. The code determines one or more features for two or more cell components, or markers, in the presence of the substance. The code can form one or more descriptors from the features. Descriptors can be formed by combining features of two or more cell components as identified using the markers. The code can then search one or more descriptors obtained from prior administered substances upon  
10 cells in order to locate descriptors having a relationship to the descriptors noted for the substance under study. The code predicts properties of the administered substance based upon the properties of the prior administered substances using the relationship between the descriptors. The code can provide for identifying properties of substances based upon effects on cell characteristics. Candidate drug mechanisms of action, potency, specificity,  
15 pharmacodynamic, and pharmacokinetic parameters, toxicity, and the like can be used as substance properties.

In another embodiment according to the present invention, computer programs for animal model selection, clinical trial design and patient management can be provided.

20 In a further embodiment according to the present invention, techniques for using cellular information in predictive methods for acquiring, analyzing and interpreting cellular data are incorporated into a computer program product including code. In one such embodiment, code for predicting properties of an unknown substance based upon information about effects of one or more known substances on a cell population is  
25 provided. The code performs a variety of tasks, such as populating a database with descriptors of cells subjected to known substances. Such descriptors can be determined from imaging the cell population. However, in some embodiments, descriptors can be derived by measurements and combinations of measurements and the like. The code determines descriptors for the unknown substance from imaging a second cell population.  
30 The second cell population has been treated with the unknown substance. Then, the code can determine a relationship between the descriptors determined from the unknown substance with the descriptors determined from the known substance. From this relationship, an inference can be made about the unknown substance.

In a yet further embodiment according to the present invention, a computer program for determining properties of a manipulation based upon effects of the manipulation on one or more cell fractions. The computer program includes code that can provide the manipulation to the cell fractions. The code can also determine one or  
5 more features of markers corresponding to cell components within the cell fractions in the presence of the manipulation. Code for forming descriptors from the features is also included. Code for searching in a database in order to locate descriptors based upon at least one of the descriptors obtained from the manipulation is also included. The computer program can include code for determining, based upon the descriptors located  
10 in the database, properties of the manipulation.

Moreover, the present invention provides computer software for mapping a manipulation of cells based upon a morphological characteristic. The computer software includes code for providing a plurality of cells, e.g., dead, live, cell fragments, cell components, cell substructures. The software also includes code for manipulating the  
15 plurality of cells, where manipulation occurs using a source(s) from one or a combination selected from an electrical source, a chemical source, a thermal source, a gravitational source, a nuclear source, a temporal source, and a biological source. The software code captures a morphological value from the plurality of cells. The morphological value can include one or any combination of characteristics such as a cell count, an area, a  
20 perimeter, a length, a breadth, a fiber length, a fiber breadth, a shape factor, an elliptical form factor, an inner radius, an outer radius, a mean radius, an equivalent radius, an equivalent sphere volume, an equivalent prolate volume, an equivalent oblate volume, an equivalent sphere surface area, an average gray value, a total gray value, and an optical density. The software code also assigns a degree of presence of the morphological value,  
25 and stores the morphological value from the plurality of cells. These values can be used for a statistical analysis to produce a statistical profile.

Still further, the present invention provides a computer program product for populating a database with manipulated biological information, e.g., cellular enzymatic activities, cellular cascades, cellular promoters, transcription factors,  
30 translation factors, cell cycle stage and apoptosis. The computer program product includes code for providing a plurality of cells in various stages of the cell cycle, where the stages of the cell cycle may include at least one selected from interphase, G0 phase, G1 phase, S phase, G2 phase, M phase which itself includes prophase, prometaphase, metaphase, anaphase, and telophase. The computer program also includes code for



manipulating each of the cells in the various stages of the cell cycle. The computer program includes code for capturing (e.g., image acquisition) an image of the plurality of manipulated cells where the code for capturing provides a morphometric characteristic of the manipulated cells. The computer program product also includes code for populating a database with the morphometric characteristic of the plurality of manipulated cells. Accordingly, the present invention provides software for populating a database, which can be queried.

Numerous benefits are achieved by way of the present invention over conventional techniques. The present invention can provide techniques for predictive cellular bioinformatics that can stream line a number of important decisions made in the drug discovery industry, medical diagnostics and biological research. The present invention can be implemented on conventional hardware including databases. In other aspects, the present invention can find useful information about substances as well as cells or portions of cells, especially morphology. Embodiments can provide a holistic approach to cell based drug discovery that enables the understanding of properties of substances based on their overall effects on cell biology. The properties include, among others, clinical uses and descriptors, human and veterinary diagnostic uses and tests, or human and veterinary prognostic uses and tests. Depending upon the embodiment, one or more of these advantages may be present. These and other benefits are described throughout the present specification.

A further understanding of the nature and advantages of the invention herein may be realized by reference to the remaining portions of the specification and the attached drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates a block diagram of a system according to an embodiment according to the present invention;

Figs. 2A-2K illustrate representative block diagrams of simplified process steps in a particular embodiment according to the present invention;

Fig. 3A-3F illustrate representative quantified descriptors of effects of manipulations on images of cells in a particular experiment;

Fig. 4 illustrates example images for different types of morphologies in a particular experiment;

Fig. 5 illustrates a distribution of various morphologies in a cell population responsive to drug concentration in a particular experiment;

Fig. 6 illustrates a graph of quantified descriptors of effects of manipulations on cell cytoarchitecture in a particular experiment;

Fig. 7 illustrates effects of external agents on cell cytoarchitecture in a particular experiment;

Fig. 8 illustrates 4 panels, one for each marker for a plurality of A549 cells in a particular experiment;

Fig. 9 illustrates 4 panels, one for each marker for a plurality of OVCAR-3 cells in a particular experiment;

Fig. 10 illustrates 4 panels for each marker for a plurality of OVCAR-3 cells at 20x in a particular experiment;

Fig. 11 illustrates 4 panels for each marker for a plurality of OVCAR-3 cells at 40x in a particular experiment;

Fig. 12 illustrates a representative input for a morphometric analysis program in a particular embodiment according to the present invention; and

Figs. 13-14 illustrate examples of the generation of pseudo-sequences and clustering in a particular embodiment according to the present invention.

## DESCRIPTION OF THE SPECIFIC EMBODIMENTS

According to the present invention, techniques for using information technology in therapeutics or drug discovery. In an exemplary embodiment, techniques for determining information about the properties of substances based upon information about the structure of living, fixed or non-living cells exposed to the substances are provided. Computer software according to the present invention enables researchers and/or scientists to identify promising candidates in the search for new and better medicines or treatments using, for example, a cellular informatics database. An embodiment according to the present invention is marketed under the name Cytometrix™, which is not intended to be limiting.

In a particular embodiment according to the present invention, a cellular informatics database is provided. Embodiments according to the present invention can provide techniques for predicting candidate drug mechanisms of action, potency, specificity, structure, toxicity and the like. In some embodiments, substances or other manipulations can be used for target identification and validation. Embodiments can be

useful in areas such as animal model selection, clinical trial design and patient management, including prognostics, drug response prediction and adverse effect prediction.

Fig. 1 depicts a block diagram of a host computer system 110 suitable for implementing the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. Host computer system 110 includes a bus 112 which interconnects major subsystems such as a central processor 114, a system memory 116 (typically RAM), an input/output (I/O) controller 118, an external device such as a display screen 124 via a display adapter 126, a keyboard 132 and a mouse 146 via an I/O controller 118, a SCSI host adapter (not shown), and a floppy disk drive 136 operative to receive a floppy disk 138. Storage Interface 134 may act as a storage interface to a fixed disk drive 144 or a CD-ROM player 140 operative to receive a CD-ROM 142. Fixed disk 144 may be a part of host computer system 110 or may be separate and accessed through other interface systems.

The system has other features. A network interface 148 may provide a direct connection to a remote server via a telephone link or to the Internet. Network interface 148 may also connect to a local area network (LAN) or other network interconnecting many computer systems. Many other devices or subsystems (not shown) may be connected in a similar manner. Also, it is not necessary for all of the devices shown in Fig. 1 to be present to practice the present invention, as discussed below. The devices and subsystems may be interconnected in different ways from that shown in Fig. 1. The operation of a computer system such as that shown in Fig. 1 is readily known in the art and is not discussed in detail in this application. Code to implement the present invention, may be operably disposed or stored in computer-readable storage media such as system memory 116, fixed disk 144, CD-ROM 140, or floppy disk 138.

Although the above has been described generally in terms of specific hardware, it would be readily apparent to one of ordinary skill in the art that many system types, configurations, and combinations of the above devices are suitable for use in light of the present disclosure. Of course, the types of system elements used depend highly upon the application. Other examples of system can be found in co-pending application U.S. Application No. \_\_\_\_\_ (Attorney Docket No. 19681-000200), which has been noted above.

Fig. 2A illustrates a representative block flow diagram of simplified process steps of a method for determining properties of a manipulation based upon effects of the manipulation on one or more portions of one or more cells in a particular embodiment according to the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. In a step 200, one or more samples of cells can be provided. These cells can be live, dead, or cell fractions. The cells also can be in one of many cell cycle stages, including G0, G1, S, G2 or M phase, which itself includes the following mitotic stages: prophase, prometaphase, metaphase, anaphase, and telophase. Cell components may be tracked using one or more markers. In a presently preferable embodiment, many useful and novel cell markers can be used.

Cell components tracked in presently preferable embodiments can include proteins, protein modifications, genetically manipulated proteins, exogenous proteins, enzymatic activities, nucleic acids, lipids, carbohydrates, organic and inorganic ion concentrations, sub-cellular structures, organelles, plasma membrane, adhesion complex, ion channels, ion pumps, integral membrane proteins, cell surface receptors, G-protein coupled receptors, tyrosine kinase receptors, nuclear membrane receptors, ECM binding complexes, endocytotic machinery, exocytotic machinery, lysosomes, peroxisomes, vacuoles, mitochondria, golgi apparatus, cytoskeletal filament network, endoplasmic reticulum, nuclear membrane, proteosome apparatus, chromatin, nucleolus, cytoplasm, cytoplasmic signaling apparatus, microbe specializations and plant specializations.

The following table illustrates some markers and cell components commonly used by embodiments according to the present invention. Other markers can be used in various embodiments without departing from the scope of the invention.

<b>Cell component</b>	<b>Marker</b>	<b>Disease State</b>
Plasma membrane (including overall cell shape)	Carbocyanine dyes Phosphatidylserine Various lipids Glycoproteins	Apoptosis-Cancer Apoptosis-Neural degenerative Ds
Adhesion complexes	Cadherins Integrins Occludin Gap junction ERM proteins CAMs Catenins Desmosomes	Thrombosis Metastasis Wound healing Inflammatory Ds Dermatologic Ds
Ion Channels and Pumps	Na/K Atpase Calcium channels Serotonin reuptake pump CFTR	Cystic fibrosis Depression Congestive Heart Failure Epilepsy
G coupled receptors	$\beta$ adrenergic receptor Angiotensin receptor	Hypertension Heart Failure Angina
Tyrosine kinase receptors	PDGF receptor FGF receptor IGF receptor	Cancer Wound healing Angiogenesis Cerebrovascular Ds
ECM binding complexes	Dystroglycan Syndecan	Muscular Dystrophy
Endocytotic machinery	Clathrin Adaptor proteins COPs Presenilins Dynamin	Alzheimer's Ds

Exocytotic machinery	SNAREs Vesicles	Epilepsy Tetanus Systemic Inflammation Allergic Reactions
Lysosomes	Acid phosphatase Transferrin	Viral diseases
Peroxisomes/Vacuoles		Neural degenerative Ds
Mitochondria	Caspases Apoptosis inducing factor F1 ATPase Fluorescein Cyclo-oxygenase	Apoptosis Neural degenerative Ds Mitochondrial Cytopathies Inflammatory Ds
Golgi Apparatus	Lens Culinaris DiOC6 carbocyanine dye COPs	
Cytoskeletal Filament Networks	Microtubules Actin Intermediate Filaments Kinesin, dynein, myosin Microtubule associated proteins Actin binding proteins Rac/Rho Keratins	Cancer Neural degenerative Ds Inflammatory Ds Cardiovascular Ds Skin Ds
Endoplasmic Reticulum	SNARE PDI Ribosomes	Neural degenerative Ds
Nuclear Membrane	Lamins Nuclear Pore Complex	Cancer
Proteosome Apparatus	Ubiquityl transferases	Cancer

Chromatin	DNA Histone proteins Histone deacetylases Telomerases	Cancer Aging
Nucleolus	Phase markers	
Cytoplasm	Intermediary Metabolic Enzymes BRCA1	Cancer
Cytoplasmic Signaling Apparatus	Calcium Camp PKC pH	Cardiovascular Ds Migraine Apoptosis Cancer
Microbe Specializations	Flagella Cilia Cell Wall components: Chitin synthase	Infectious Ds
Plant specializations	Choloroplast Cell Wall components	Crop Protection

Then, in a step 202, one or more samples of the manipulation can be provided to one or more of the cells or cell fractions. Manipulations can comprise chemical, biological, mechanical, thermal, electromagnetic, gravitational, nuclear, temporal factors, and the like. For example, manipulations could include exposure to chemical compounds, including compounds of known biological activity such as therapeutics or drugs, or also compounds of unknown biological activity. Or exposure to biologics that may or may not be used as drugs such as hormones, growth factors, antibodies, or extracellular matrix components. Or exposure to biologics such as infective materials such as viruses that may be naturally occurring viruses or viruses engineered to express exogenous genes at various levels. Bioengineered viruses are one example of manipulations via gene transfer. Other means of gene transfer are well known in the art and include but are not limited to electroporation, calcium phosphate precipitation, and lipid-based transfection. Manipulations could also include delivery of

antisense polynucleotides by similar means as gene transfection. Other genetic manipulations include gene knock-outs gene over-expression or gene mutations. Manipulations also could include cell fusion. Physical manipulations could include exposing cells to shear stress under different rates of fluid flow, exposure of cells to different temperatures, exposure of cells to vacuum or positive pressure, or exposure of cells to sonication. Manipulations could also include applying centrifugal force. Manipulations could also include changes in gravitational force, including sub-gravitation. Manipulations could include application of a constant or pulsed electrical current. Manipulations could also include irradiation. Manipulations could also include photobleaching which in some embodiments may include prior addition of a substance that would specifically mark areas to be photobleached by subsequent light exposure. In addition, these types of manipulations may be varied as to time of exposure, or cells could be subjected to multiple manipulations in various combinations and orders of addition. Of course, the type of manipulation used depends upon the application.

Then, in a step 204, one or more descriptors of a state in the portions of the cells in the presence of the manipulation can be determined based upon the images collected by the imaging system. Descriptors can comprise scalar or vector values, representing quantities such as area, perimeter, dimensions, intensity, aspect ratios, and the like. Other types of descriptors include one or any combination of characteristics such as a cell count, an area, a perimeter, a length, a breadth, a fiber length, a fiber breadth, a shape factor, an elliptical form factor, an inner radius, an outer radius, a mean radius, an equivalent radius, an equivalent sphere volume, an equivalent prolate volume, an equivalent oblate volume, an equivalent sphere surface area, an average intensity, a total intensity and an optical density. In some embodiments, descriptors can include averages or standard deviation values, or frequency statistics from other descriptors collected across a population of cells. In some embodiments, descriptors can be reduced using techniques such as principal component analysis and the like. A presently preferable embodiment uses descriptors selected from the following table. Other descriptors can also be used without departing from the scope of the invention.



Name of Parameter	Explanation/Comments
Count	Number of objects
Area	
Perimeter	
Length	X axis
Width	Y axis
Shape Factor	Measure of roundness of an object
Height	Z axis
Radius	
Distribution of Brightness	
Radius of Dispersion	Measure of how dispersed the marker is from its centroid
Centroid location	x-y position of center of mass
Number of holes in closed objects	Derivatives of this measurement might include, for example, Euler number (= number of objects - number of holes)
Elliptical Fourier Analysis (EFA)	Multiple frequencies that describe the shape of a closed object
Wavelet Analysis	As in EFA, but using wavelet transform
Interobject Orientation	Polar Coordinate analysis of relative location
Distribution Interobject Distances	Including statistical characteristics
Spectral Output	Measures the wavelength spectrum of the reporter dye. Includes FRET
Optical density	Absorbance of light
Phase density	Phase shifting of light
Reflection interference	Measure of the distance of the cell membrane from the surface of the substrate
1,2 and 3 dimensional Fourier Analysis	Spatial frequency analysis of non closed objects
1,2 and 3 dimensional Wavelet Analysis	Spatial frequency analysis of non closed objects
Eccentricity	The eccentricity of the ellipse that has the same second moments as the region.

	A measure of object elongation.
Long axis/Short Axis Length	Another measure of object elongation.
Convex perimeter	Perimeter of the smallest convex polygon surrounding an object
Convex area	Area of the smallest convex polygon surrounding an object
Solidity	Ratio of polygon bounding box area to object area.
Extent	proportion of pixels in the bounding box that are also in the region
Granularity	
Pattern matching	Significance of similarity to reference pattern
Volume measurements	As above, but adding a z axis

Then, in a step 205, a database of cell information can be provided. Next, in a step 206, a plurality of descriptors can be searched from a database of cell information in order to locate descriptors based upon one of the descriptors of the manipulation. Then, in a step 208, properties of the manipulation are determined based upon the properties of the located descriptors. Properties can comprise toxicity, specificity against a subset of tumors, mechanisms of chemical activity, mechanisms of biological activity, structure, adverse biological effects, biological pathways, clinical effects, cellular availability, pharmacological availability, pharmacodynamic properties, clinical uses and descriptors, pharmacological properties, such as absorption, excretion, distribution, metabolism and the like.

In a particular embodiment, step 206 comprises determining matching descriptors in the database corresponding to a prior administration of the manipulation to the descriptors of the present administration of the manipulation. In a particular embodiment according to the present invention, measurements of scalar values can provide predictive information. A database can be provided having one or more "cellular fingerprints" comprised of descriptors of cell-substance interactions of drugs having known mechanisms of action with cells. Such fingerprints can be analyzed, classified and/or compared using a plurality of techniques, such as statistical classification and clustering, heuristic classification techniques, a technique of creating "phylogenetic trees" based on various distance measures between cellular fingerprints from various drugs. In a

present embodiment, scalar, numeric values can be converted into a nucleotide or amino acid letter. Once converted into a corresponding nucleotide representation, the fingerprints can be analyzed and compared using software and algorithms known in the art for genetic and peptide sequence comparisons, such as GCG, a product of Genetics Computer Group, with company headquarters in Madison WI. In an alternative embodiment, numeric values for the fingerprints can be used by comparison techniques. A phylogenetic tree can be created that illustrates a statistical significance of the similarity between fingerprints for the drugs in the database. Because the drugs used to build the initial database are of known mechanism, it can be determined whether a particular scalar value in a fingerprint is statistically predictive. Finally, a compound fingerprint with no known mechanism of action can be queried against the database and be statistically compared and classified among the drugs in the database that the compound most resembles.

In a particular embodiment, relationships between measured morphological properties of images and physiological conditions can be determined. Relationships can include, for example, treatment of different cell lines with chemical compounds, or comparing cells from a patient with control cells, and the like. In a presently preferable embodiment, a clustering can be performed on acquired image feature vectors. Some embodiments can comprise statistical and neural network - based approaches to perform clustering and fingerprinting of various features. The foregoing is provided as merely an example, and is not intended to limit the scope of the present invention. Other techniques can be included for different types of data.

In some embodiments, clustering and fingerprinting can be performed on features extracted from cell images. In a presently preferable embodiment, procedures for comparisons and phylogenetic analysis of biological sequences can be applied to data obtained from imaging cells.

Select embodiments comprising such approaches enable the use of a broad array of sophisticated algorithms to compare, analyze, and cluster gene and protein sequences. Many programs performing this task are known to those of ordinary skill in the art, such as for example, <http://evolution.genetics.washington.edu/phylip.html>, and <http://evolution.genetics.washington.edu/phylip/software.html>.

Embodiments can perform such analysis based upon factors such as numerical value, statistical properties, relationships with other values, and the like. In a particular embodiment, numbers in a numerical features vector can be substituted by one

or more of nucleic acid or amino acid codes. Resulting "pseudo-sequences" can be subjected to analysis by a sequence comparison and clustering program. Depending upon the application, many different ways of using the database can be provided. Further details of a step of manipulation are noted more particular below.

Fig. 2B illustrates a representative block flow diagram of simplified process steps for determining one or more descriptors of a state in the portions of the cells in the presence of the manipulation of step 204 of Fig. 2A in a particular embodiment according to the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. In a step 212, a picture of a target is obtained. A target can be one or more cells, or portions of cells in select embodiments according to the invention. Then, in a step 214, a digitized representation of the picture obtained in step 212 is determined. In some embodiments, steps 214 and step 212 can comprise a single step. These embodiments use a digital imaging means such as a digital camera, to obtain a digital image of the target directly. Next, in a step 216, the digital representation of the image is processed to obtain image features. Image features can include such quantities as area, perimeter, dimensions, intensity, gray level, aspect ratios, and the like. Then, in a step 218 descriptors can be determined from the image features. Descriptors can comprise scalar or vector quantities and can comprise the image descriptors themselves, as well as derived quantities, such as shape factor derived by a relationship  $4\pi * \text{area} / \text{perimeter}$ , and the like.

In a preferred embodiment, cells can be placed onto a microscope, such as a Zeiss microscope, or its equivalent as known in the art. A starting point, named Site A1, is identified to the microscope. A plurality of exposure parameters can be optimized for automated image collection and analysis. The microscope can automatically move to a new well, automatically focus, collect one or more images, move to a next well, and repeat this process for designated wells in a multiple well plate. A file having a size and an intensity distribution measurement for each color and rank for each well can then be created for the images acquired. Based on this information, a user or a computer can revisit sites of interest to collect more data, if desired, or to verify automated analysis. In a presently preferred embodiment, image automatic focus and acquisition can be done using computer software controlling the internal Z-motor of the microscope. Images are taken using a 10x, 20x, or 40x air long working distance objectives. Sometimes multiple

images are collected per well. Image exposure times can be optimized for each fluorescent marker and cell line. The same exposure time can be used for each cell line and fluorescent marker to acquire data.

Fig. 2C illustrates a representative block flow diagram of simplified process steps for obtaining images of cell components of step 212 of Fig. 2B in a particular embodiment according to the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. Fig. 2C illustrates a step 220, of providing a sample to the imaging device. Samples can be provided in 96 well plates and the like. The sample may be loaded into a microscope, such as a Zeiss microscope or equivalent. In a step 222, a light is used to illuminate the first sample, which may be contained in a first well designated A1. Then, in a step 224, an automatic focusing procedure is performed for the site. In a particular embodiment, the plate holding the samples is moved to perform automatic focusing of the microscope. In an alternative embodiments, focusing can be performed by moving optical components of the microscope and the like. In a step 226, images are collected for the site. Images can be collected for every color at every site. Present embodiments can provide images for up to four colors. However, embodiments are contemplated that can provide more colors by using either a monochromator or by digitally separating overlapping fluorophores. Cell growth and density information is collected. In some embodiments, imaging can be facilitated using one or more biosensors, molecules such as non-proteins, i.e., lipids and the like, that are luminescently tagged. However, some embodiments can also use fluorescence polarization and the like. Further, embodiments can detect differences in spectral shifts of luminescent markers. In a step 228, a determination is made whether more images need to be taken for a particular color. If this is so, then processing continues at step 226 with a different color. Otherwise, processing continues with a decisional step 230. Images can now be taken by repeating step 226. In a step 230, a determination is made whether more images need to be taken in order to obtain images for all fields of view for the sample. If this is so, then in a step 232 a field of view is determined and the sample is moved to this new field of view. Images for the new field of view can now be taken by repeating step 226. Then, in a decisional step 234, after images for fields of view in a sample have been obtained, a determination is made whether any further samples remain to be analyzed. If so, a new sample is brought into view and processing continues with step 220. Otherwise, image processing is complete

and data analysis is performed on the images. In a presently preferable embodiment, image data can be stored on a CD ROM using a CD ROM burner, removable storage units, such as ZIP drives made by IOMEGA, and the like. However, other mass storage media can also be used.

Fig. 2D illustrates a representative block flow diagram of simplified process steps for processing digitized representations of step 216 of Fig. 2B in a particular embodiment according to the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. Fig. 2D illustrates a step 240, of thresholding a digitized image input. Thresholding provides a specific intensity level, such that pixels darker than the threshold are deemed black, and pixels lighter than the threshold are considered white. The resulting image can be processed using binary image processing techniques in order to extract regions. Then, in a step 242, the digitized image input is subjected to edge detection. Edge detection can be accomplished by means of passing a Sobol operator over the entire image and computing new pixel values based upon the contents of the Sobol operator and the original image. However, embodiments can also use other techniques, such as Fast Fourier Transforms (FFT) and the like as known in the art without departing from the scope of the present invention. Then, in a step 244, the regions and objects determined by step 240 and step 242 can be determined based upon image processing techniques.

In a step 246, the regions and objects determined by step 244 can be processed in view of a plurality of classification heuristics to determine cell state based upon selectable criteria. Further, in some embodiments, morphological criteria can be used based upon a cell type to determine cell state. Next, in a step 248, a plurality of region features can be determined. For example, in a representative embodiment, image features can include such quantities as area, perimeter, dimensions, intensity, gray level, aspect ratios, and the like.

In a particular embodiment according to the present invention, data analysis techniques for describing the fluorescence patterns of markers in multiple cell lines in the presence and absence of compounds are provided. Automated image analysis techniques can include determining one or more regions from around nuclei, individual cells, organelles, and the like, called "objects" using a thresholding function. Objects that reside on the edge of an image can be included or excluded in various embodiments. An average population information about an object can be determined and recorded into a

database, which can comprise an Excel spreadsheet, for example. However, embodiments can use any recording means without departing from the scope of the present invention. Values measured can be compared to the visual image. One or more types of numerical descriptors can be generated from the values. For example, descriptors such as a Number of objects, an Average, a standard deviation of objects, a Histogram (number or percentage of objects per bin, average, standard deviation), and the like can be determined.

In a particular embodiment according to the present invention, data can be analyzed using morphometric values derived from any of a plurality of techniques commonly known in the art. Fluorescent images can be described by numerical values, such as for example, an area, a fluorescence intensity, a population count, a radial dispersion, a perimeter, a length, and the like. Further, other values can be derived from such measurements. For example, a shape factor can be derived according to a relationship  $4\pi * \text{area} / \text{perimeter}$ . Other values can be used in various embodiments according to the present invention. Such values can be analyzed as average values and frequency distributions from a population of individual cells.

In a particular embodiment according to the present invention, techniques for the automatic identification of mitotic cells are provided. Image analysis techniques employing techniques such as multidimensional representations, frequency-based representations, multidimensional cluster analysis techniques and the like can be included in various embodiments without departing from the scope of the present invention. Techniques for performing such analyses are known in the art and include those embodied in MatLab software, produced by MathWorks, a company with headquarters in Natick, MA.

Scalar values providing efficacious descriptors of cell images can be identified using the techniques of the present invention to perform predictive analysis of drug behavior. In a presently preferred embodiment, a plurality of heterogenous scalar values can be combined to provide predictive information about substance and cell interactions.

Fig. 2E illustrates a representative work flow diagram of simplified process steps for designing and applying analysis techniques for prediction of properties of manipulations in a particular embodiment according to the present invention. This diagram is merely an illustration and should not limit the scope of claims herein. One of

ordinary skill in the art would recognize other variations, modifications, and alternatives. Fig. 2E illustrates an input data of descriptors of known manipulations with known properties. A step 320 of reformatting and transforming data 319 to formats suitable for analysis is performed. Additionally, a "cleaning", or "cleansing" step can eliminate outlying and/or incomplete data points and the like in the data. Then at step 322 a set of models is being built based on data from step 320. Performance of each of these models is evaluated at step 324 and steps 320, 322, and 324 are repeated until a desired performance and error rates are achieved. Data transformations and prediction methods, including a particular neural network, mathematical equation, classification and decision trees and/or the like, that satisfy these criteria are selected at step 326 and a solution based on these transformations and methods is generated at step 328. Formatting and transformations, based upon procedures and parameters selected in step 326, are applied to descriptors of unknown manipulations 318 at step 330. Reformatted and transformed data from step 330 is analyzed using a generated solution 328, and predictions about unknown manipulations are generated at step 316, based on this analysis (332) and known properties of known manipulations 317.

Fig. 2F illustrates a representative block flow diagram of simplified process steps for a method of mapping a manipulation of cells to a morphological characteristic in a particular embodiment according to the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. Fig. 2F illustrates a step 250, wherein a plurality of cells, e.g., living cells, fixed cells or dead cell fractions, cell substructures, cell components are provided. Then, in a step 252, the plurality of cells is manipulated, where manipulation occurs using a source(s) from one or a combination selected from an electrical source, a chemical source, a thermal source, a gravitational source, a nuclear source, a temporal source, and a biological source. Next, in a step 254, a morphological value is captured from the plurality of cells. The morphological value can include one or any combination of characteristics such as a cell count, an area, a perimeter, a length, a breadth, a fiber length, a fiber breadth, a shape factor, an elliptical form factor, an inner radius, an outer radius, a mean radius, an equivalent radius, an equivalent sphere volume, an equivalent prolate volume, an equivalent oblate volume, an equivalent sphere surface area, an average gray value, a total gray value, and an optical density. Then, in a step 256, a degree of presence of the morphological value is assigned. In a step 258, the morphological value



from the plurality of cells is stored in a memory location. From the memory location the values can be used for a statistical analysis to produce a statistical profile.

Fig. 2G illustrates a representative block flow diagram of simplified process steps for populating a database with manipulated biological information, e.g., cellular enzymatic activities, cellular cascades, cellular promoters, transcription factors, translation factors, cell cycle stage and apoptosis, in a particular embodiment according to the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. Fig. 2G illustrates a step 260, wherein a plurality of cells in various stages of the cell cycle, such as for example, interphase, G0 phase, G1 phase, S phase, G2 phase, M phase, which itself includes prophase, prometaphase, metaphase, anaphase, and telophase, are provided. Then, in a step 262, each of the cells in the various stages of the cell cycle is manipulated. Next, in a step 264, an image of the plurality of manipulated cells is captured using image acquisition techniques in order to provide a morphometric value for the manipulated cells. Finally, in a step 266, a database is populated with the morphometric value. The database can later be queried based upon the morphometric value.

Fig. 2H illustrates a representative block flow diagram of simplified process steps for a method for populating a database with manipulated biological information, e.g., image acquisition parameters, image feature summary information, and well experimental parameters in a particular embodiment according to the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. Fig. 2H illustrates a step 280 in which cells are placed into site on a plate and a manipulation is applied. Then, in a step 281 an image is taken of the cells. In step 282, the image is transferred to an image archive database. Then, in a step 283, well experimental parameters are entered into the database 287. Well experimental parameters can include cell type, manipulation and the like. In a step 284, image acquisition parameters are transferred to database 287. Image acquisition parameters can include file name, fluorophores and the like. In a step 285, the image acquired in step 281 is analyzed. Then, in step 286, an image feature summary from the analysis step 285 is transferred to database 287.

In step 288, a lookup table for all analyses is provided to database 287. The lookup table provides information about the analyses. In a step 289, a query of

database 287 for process data is performed. The results are reformatted. Then in a step 290, the database 287 is queried. Next, in a step 291, features of the manipulations stored in the database are combined and reduced. Next, in a step 293, reduced features of step 291 can be compared. In a step 292, the results of step 293 are recorded in database 287. Then, in a step 294, a report of predictions based on comparisons performed in step 293 is generated.

Fig. 2I illustrates a representative block flow diagram of simplified process steps for acquiring images of manipulated biological information, e.g., cells, cell tissues, and cell substituents in a particular embodiment according to the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. Fig. 2I illustrates a step 270 in which a user sets up an image analysis procedure. Then, in a step 272, an image is read into image analysis software. Next, in a step 274, patterns and objects are identified in the image using one or more algorithms. Next, in a step 276, sets of features are extracted from the image. Then, in a step 278, feature information, descriptor values and the like are exported to the database, such as database 287 of Fig. 2H, for recording. Next, in a decisional step 279, a determination is made whether any more images should be taken. If this is so, processing continues with step 272. Otherwise, image acquisition processing is completed.

Fig. 2J illustrates a representative block flow diagram of simplified process steps for populating, acquiring and analyzing images of manipulated biological information in a particular embodiment according to the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. Fig. 2J illustrates a step 300 of placing a plate onto an imaging stage and reading a bar code. Then, in a step 301 an autofocus procedure is performed. Next, in a step 302, a first optical filter configuration is selected and an image is collected. Then, in a decisional step 303, a determination is made whether more than one image per optical configuration can be taken. If so, then, in a step 304, a new position within the well is targeted and another image is collected. Then, in a decisional step 305, a determination is made whether any more images need to be collected. If this is so, step 304 is repeated until all images for a particular well have been collected. After one or more images are collected for the well, in a step 306, the stage is returned to a starting position within the

well, and a montage is created from collected images. The results are named with a unique file name and stored.

In a decisional step 307, a determination is made whether any more optical channels in the well can be imaged. If this is so, then in a step 308 the next optical filter configuration is selected and an image is collected. Processing then continues with decisional step 303, as described above. Otherwise, if no further optical channels in the well can be imaged, then in a decisional step 309 a determination is made whether any wells remain to be imaged. If not all wells have been imaged, then in a step 310, the stage moves to the next well and processing continues with step 301, as described above. Otherwise, if all wells on the plate have been imaged, then in a decisional step 311, a determination is made whether any more plates can be processed. If this is so, then processing continues with step 300 as described above. Otherwise, in a step 312, the information is stored to a CD or other storage device as a backup.

Fig. 2K illustrates a representative block flow diagram of simplified process steps compound based upon information about effects of one or more known compounds on a cell population in a particular embodiment according to the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. Fig. 2K illustrates a step 340 of populating a database with descriptors for known compounds. Such descriptors can be determined from imaging the cell population. However, in some embodiments, descriptors can be derived by measurements and combinations of measurements and the like. Then, in a step 342, descriptors for the unknown compound are determined from imaging a second cell population. The second cell population has been treated with the unknown compound. Then, in a step 344, a relationship between the descriptors determined from the unknown compound with the descriptors determined from the known compounds can be determined. Finally, in a step 346, an inference can be made about the unknown compound based upon the descriptors of the known compounds from the relationship determined in step 344.

Accordingly, the present invention provides a novel database design. In a particular embodiment according to the present invention, a method for providing a database comprises measurement of a potentially large number of characteristics of one or more sub-cellular morphometric markers. Markers can be from any of a large variety of normal and transformed cell lines from sources such as for example, human beings,

fungi, or other species. The markers can be chosen to cover many areas of cell biology, such as, for example markers comprising the cytoskeleton of a cell. The cytoskeleton is one of a plurality of components that determine a cell's architecture, or "cytoarchitecture". A cytoarchitecture comprises structures that can mediate most cellular processes, such as cell growth and division, for example. Because the cytoskeleton is a dynamic structure, it provides a constant indication of the processes occurring within the cell. The cytoarchitecture of a cell can be quantified to produce a one or more scalar values corresponding to many possible cellular markers, such as cytoskeleton, organelles, signaling molecules, adhesion molecules and the like. Such quantification can be performed in the presence and absence of drugs, peptides, proteins, anti-sense oligonucleotides, antibodies, genetic alterations and the like. Scalar values obtained from such quantification can provide information about the ongoing cell biological function and physiologic state of the cell.

In a presently preferred embodiment, scalar values can comprise morphometric, frequency, multi-dimensional parameters and the like, extracted from one or more fluorescence images taken from a number of cellular markers from a population of cells. A vector of two or more such scalar values extracted from a plurality of cell lines and markers grown in the same condition together comprise a unique "fingerprint" that can be incorporated into a database. Such cellular fingerprints will change in the presence of drugs, peptides, proteins, antisense oligonucleotides, antibodies or genetic alterations. Such changes can be sufficiently unique to permit a correlation to be drawn between similar fingerprints. Such correlations can predict similar behaviors or characteristics with regard to mechanism of action, toxicity, animal model effectiveness, clinical trial effectiveness, patient responses and the like. In a presently preferred embodiment, a database can be built from a plurality of such fingerprints from different cell lines, cellular markers, and compounds having known mechanisms of action (or structure, or gene response, or toxicity).

The present invention also provides database and finger print comparisons according to other embodiments. In a particular embodiment according to the present invention, measurement of scalar values can provide predictive information. A database can be provided having one or more "cellular fingerprints" comprised of descriptors of cell substance interactions of drugs having known mechanisms of action with cells. Such fingerprints can be compared using a plurality of techniques, such as a technique of creating "phylogenetic trees" of a statistical similarity between the cellular fingerprints

from various drugs. In a present embodiment, scalar, numeric values can be converted into a nucleotide or amino acid letter. Once converted into a corresponding nucleotide representation, the fingerprints can be analyzed and compared using software and algorithms known in the art for genetic and peptide sequence comparisons, such as GCG, a product of Genetics Computer Group, with company headquarters in Madison WI. In an alternative embodiment, numeric values for the fingerprints can be used by comparison techniques. A phylogenetic tree can be created that illustrates a statistical significance of the similarity between fingerprints for the drugs in the database. Because the drugs used to build the initial database are of known mechanism, it can be determined whether a particular scalar value in a fingerprint is statistically predictive. Finally, a compound fingerprint with no known mechanism of action can be queried against the database and be statistically compared and classified among the drugs in the database that the compound most resembles.

In a particular embodiment, relationships between measured morphological properties of images and physiological conditions can be determined. Relationships can include, for example, treatment of different cell lines with chemical compounds, or comparing cells from a patient with control cells, and the like. In a presently preferable embodiment, a clustering can be performed on acquired image feature vectors. Some embodiments can comprise statistical and neural network - based approaches to perform clustering and fingerprinting of various features. The foregoing is provided as merely an example, and is not intended to limit the scope of the present invention. Other techniques can be included for different types of data.

In some embodiments, clustering and fingerprinting can be performed on features extracted from cell images. In a presently preferable embodiment, procedures for comparisons and phylogenetic analysis of biological sequences can be applied to data obtained from imaging cells.

Embodiments can perform such analysis based upon factors such as numerical value, statistical properties, relationships with other values, and the like. In a particular embodiment, numbers in a numerical features vector can be substituted by one or more of nucleic acid or amino acid codes. Resulting "pseudo-sequences" can be subjected to analysis by a sequence comparison and clustering program.

Other types of databases can also be provided according to other embodiments. The database includes details about the behavior of a plurality of standard drugs of known mechanism in the universal assay, called a morphometric cellular

response. However, the comparative value need not be limited to drugs having a known mechanism of action. When the profile of a test compound is compared to the database, predictions about the test compound can be made against any known parameter of the other compounds in the database. For example, information about a compound in the database could include structure, mechanism of action, clinical side effects, toxicity, specificity, gene expression, affinity, kinetics, and the like. The fingerprint of a compound of unknown structure from a natural products library could be compared to the fingerprint of drugs with known structure and the structure could be deduced from such a comparison. Similarly, such information could lead to better approaches to compound analoging, pre-clinical animal modeling, clinical trial design (side effects, dose escalation, patient population) and the like.

According to the present invention, databases can be integrated with and complementary to existing genomic databases. Differential genomic expression strategies can be used for drug discovery using database technology. In one particular embodiment, cell data and morphometric cellular response data can be associated with a genetic expression profile assay to form a single assay. Live cells expressing fluorescence markers can be treated with a drug, imaged and analyzed for morphometry; and then analyzed for mRNA for expression. Such embodiments can provide rapid development of tools to link cellular behavior with genomics.

Database methods according to the present invention can be used to predict gene function and to assist in target validation. Databases that include genetic diversity, i.e., having cellular fingerprints from cells of differing genetic backgrounds (tumor, tissue specific, and gene knock out cell lines), can provide the capability to compare cells of unknown genetic background to those in the database. Similarly, fluorescent patterns of an unknown cellular marker in the presence of multiple drugs can be queried against the patterns of the known markers in the database. For example, if an unknown gene is tagged with Green Fluorescent Protein (GFP), the database may be used to identify the cellular structures for which that unknown gene encodes.

According to the present invention, target validation and cell-based assay screening can be performed using database system and methods to serve as a universal high-throughput cell-based assay that can evaluate the molecular mechanism of drug action. As new genes are isolated and identified, a large collection of available gene based knowledge is becoming available. From this large collection of new genes, potential targets can be identified using the genomic tools of sequence analysis and

expression profiling. However, unless a gene mutation is tightly linked to a disease state, further validation of individual targets is a time consuming process, becoming a bottleneck in drug discovery. Furthermore, robotics and miniaturization are making "High Throughput Screening (HTS)" the industry standard, substantially reducing the time and cost of running a target-based biochemical assay. Therefore, it is now possible to routinely screen large libraries and use a resulting "hit" to validate the target. In such approaches, a specialized cell-based assay would be developed to test hits for each target. Since this often involves the creation of cell lines expressing new markers, this stage may also become a bottleneck that cannot keep pace with HTS. In addition, these assays may not be amenable to high-throughput screening, making it difficult to test the increasing number of analogs arising from combinatorial chemistry.

In a particular embodiment according to the invention, a rapid characterization of large compound libraries for potential use as pharmaceutical products can be provided by predicting compound properties such as mechanisms of action. In many drug discovery situations, virtually millions of compounds can be passed through an HTS assay against one or two validated targets. These assays produce hundreds to thousands of potential hits that can be narrowed down to a selective few. These hits can then be subsequently screened by a pipeline of secondary and tertiary screens to further characterize their specificity, often time completely missing non-specific interactions with other proteins. Techniques according to the present invention can provide a replacement to such screening operations by providing information about cellular accessibility and mechanism of action for the substances usually placed on HTS systems. The cell information can be predictive of whether to continue into an animal model for each compound, and which animal model to pursue.

In some embodiments, techniques according to the present invention can provide tools for the later stages of drug development such as clinical trial design and patient management. The predictive value of the known drug trial and patient response information will be used in a similar fashion as the pre-clinical information. Because the human cell is the locus of drug action, a database containing cellular interactions can be able to provide predictive value for this aspect of drug development.

## **EXPERIMENTS**

To prove the principle and demonstrate the objects of the present invention, experiments have been performed to determine the effects of manipulations on

cell structure based upon imaging techniques applied to a variety of indications. These experiments were performed by growing multiple cell lines in the presence of multiple compounds, or substances. A fix and stain of cells using antibodies or labels to multiple cellular markers was performed. One or more images of the cells were then obtained using a digital camera. Indications were built by quantifying and/or qualifying patterns of each marker in the cell lines under study. A database was built from the indications.

As the database grows, it should be able to predict the mechanism of action and other compound properties of an unknown drug by comparing its effect with the effects of known compounds or to identify data clusters within large libraries of compounds.

In a first experiment, an automated method to count the number of cells and differentiate normal, mitotic, and apoptotic cells was created. Approximately 5,000 HeLa cells were plated per well in a 96 well plate and grown for 3.5 days. The cells were fixed with  $-20^{\circ}$  MEOH for 5 minutes, washed with TBS for 15 minutes, and then incubated in 5 mg/ml Hoechst 33342 in TBS for 15 minutes. Then, 72 images were collected with a 40x objective and 75 ms exposure time.

The analysis was performed on objects that met a certain size criteria that was based on 1) measuring the size of objects in the image that were clearly not cells and 2) excluding the first peak of the area histogram.

Histograms of the individual object data were generated for each type of information. Fig. 3A shows the histogram for average gray value, and Fig. 3B shows histogram data for the area of each object. Fig. 3C shows the scatter plot of the average gray value vs. the area of all of the objects. The pattern of the scatter plot showed an interesting pattern: a large cluster of cells in one region of the graph, with a scattering of object points in other regions. Because mitotic structures are identified as particularly bright objects, most likely due to the biological fact that the chromatin is condensed, it seemed reasonable to go back to the original Hoechst images and the identify the cells which were either undergoing mitosis, or otherwise looked abnormal. Manual inspection of 917 cells resulted in the classification of each object. Fig. 3D shows a graph where each type of cellular classification is delimited. This graph clearly shows that the mitotic nuclei are exclusively brighter than the interphase nuclei. Further, the different phases of the cell cycle can be separated using these two parameters. Figs. 3E-3F show the bar graphs of the average and standard deviations of the areas and average gray values for



each cell classification type. These graphs shows that interphase nuclei are statistically less bright than mitotic nuclei and that telophase nuclei are statistically smaller than other mitotic nuclei.

Each image was thresholded to a level of 20. A standard area value was set at 9500 pixels. Automated information gathering about all of the objects was done and collected into an Excel spreadsheet (for more information see, section on imaging system). The following information was recorded:

<b>Image Name</b>	<b>Average gray value</b>
Object #	Total gray value
Area	Optical density
Standard area count	Radial dispersion
Perimeter	Texture Difference Moment
Fiber length	EFA Harmonic 2, Semi-Major Axis
Fiber breadth	EFA Harmonic 2, Semi-Minor Axis
Shape factor	EFA Harmonic 2, Semi-Major Axis Angle
Ell. form factor	EFA Harmonic 2, Ellipse Area
Inner radius	EFA Harmonic 2, Axial Ratio
Outer radius	EFA Harmonic 3, Semi-Minor Axis
Mean radius	

The following results were obtained:

- 1,250 objects were counted
- 201 of those objects has standard area counts  $> 2$  (area  $> 19000$  pixels)
- 195 objects had areas  $< 6000$  pixels
- 1529 objects estimated in total
- 1328 object areas are  $> 6000$  pixels
- The data was reduced to 917 objects that were  $6000 < \text{area} < 19000$
- For the 917 objects a scatter plot of area vs. average gray value and a histogram of the average gray value were generated.
- 116 objects that had average gray value intensities  $> 60$  were manually looked at to determine their morphology.
- Of those 116 objects:

6 were dead or indistinguishable  
 4 were interphase  
 30 were prophase  
 32 were metaphase  
 24 were anaphase  
 20 were telophase (10 pairs)

- 12 prophase objects were missed because of gray scale cut off. (8 of those prophase cells had gray scale values  $> 57$ , as did 7 interphase)
- 1 telophase object was missed because it was too small ( $< 6000$ )
- 1 prophase object was missed because it was too big ( $> 1900$ )
- 16 mitotic objects were missed because they were parts of objects with standard count  $> 2$ .

In sum, out of 917 single objects, the analysis correctly identified 106 out of 130 mitotic objects, or (81% predictive, 91% of identified mitotics). Out of 917 single objects, the analysis incorrectly identified only 10 non-mitotics as mitotics (1% total, 8% of identified mitotics); 14 mitotics as interphase (1.4% total, 1% interphase).

The next step is to develop an automated classification system which will automatically assign values to each object using these or other measurement parameters.

In a second experiment, the effects of Taxol on MDCK cells and the different types of morphological effects were observed. A plurality of MDCK cells grown in 96 well plates were treated with Taxol for 4.5 hours at different concentrations (10  $\mu\text{M}$ -1pM). They were then fixed, labeled with Hoechst, and imaged.

This experiment used a labeling protocol comprising: MEOH fix at  $-20^{\circ}$ , Wash in PBS, Block in PBS/BSA/Serum/Triton-X 100, Incubate with 5  $\mu\text{g}/\text{ml}$  Hoechst 10 minutes, and Wash.

The results of the experiment are that cells were inspected for different morphologies and manually counted at each different drug concentration in one well. Fig. 4 shows example images from each drug concentration and the different types of morphologies are highlighted. Fig. 5 shows the distribution of each morphology within the cell population as a function of drug concentration. The higher the concentration of Taxol, the larger proportion of cells underwent apoptosis, and the fewer number of normal mitotic cells were detected.

The next step is to test the automated Hoechst analysis of the first experiment with multiple drugs.

In a third experiment, the purpose is to determine whether the automated analysis methods developed in the first experiment can detect differences in Hoechst morphology in the presence of 6 known compounds at one concentration and exposure time in one cell line. In this experiment, HeLa cells were treated with 6 compounds with known mechanism of action. The quantitative methods described in the first experiment were applied to the Hoechst images.

Approximately 5,000 HeLa cells per well were plated in a Costar black walled 96 well tissue culture treated plate and left to recover in the incubator for 24 hours. After this time, 10 ug/mL of cytochalasin D (CD), Taxol, hydroxyurea, vinblastine, and nocodazole, and staurosporine was added to different wells at a 1:100 addition in DMSO. The cells were incubated in the presence of drug for 24 more hours. After 24 hours, the cells were removed and fixed as in the first experiment. Then, 9 images per well were collected of the Hoechst staining using a 10x objective.

The results of this experiment were that the low magnification images taken of Hoechst were run through the automated image analysis method described in the first experiment. Plots of the average gray value and area were made of each compound. Fig. 6 shows the scatter plots of the compounds. The scatter plots of each compound are visually distinct. For example, cells treated with CD are smaller than control, and cells treated with Hydroxyurea are larger and brighter. Furthermore, the number of cells per well was very different (data not shown).

Based upon the results of this experiment, it can be concluded that these initial attempts at automatically identifying changes in cellular morphology demonstrate that the effects of different compounds can be distinguished. This method can also be used to count adherent cells.

The next steps that can be taken based upon the results of this experiment are to develop clustering algorithms that will assign statistically meaningful values to the representative two dimensional data shown in Fig. 5, and even more complicated clustering of all of the multidimensional data that can be extracted across one, and multiple markers.

In a fourth experiment was performed to obtain high magnification images of two markers in the presence of drugs. In this experiment, HeLa cells were treated with

80 generic compounds with known mechanism of action. The quantitative methods described in the first experiment were applied to the Hoechst images.

Approximately 5,000 HeLa cells per well were plated in a Costar black walled 96 well tissue culture treated plate and left to recover in the incubator for 24 hours. After this time, 10 ug/mL of each compound from the Killer Plate from Microsource Discovery Systems (Gaylordsville, CT) was added to different wells at a 1:100 addition in DMSO. The cells were incubated in the presence of drug for 24 more hours. After 24 hours, the cells were removed and fixed as in the first experiment. In addition to being labeled with Hoechst 33342 (against chromatin), cells were also labeled with 1 unit of rhodamine-conjugated phalloidin (against actin) for 30 minutes.

The 96 well plate was imaged twice. Once, 9 images per well were collected of the Hoechst staining using a 10x objective. After this, one image per well of both the phalloidin and Hoechst staining was collected using a 40x objective.

The resulting high magnification images were analyzed qualitatively and distinct pattern differences were detected in both the Hoechst and phalloidin images. Fig. 7 shows three example images from the experiment. The top row is the Hoechst staining, and the bottom row is the phalloidin staining from the same well. The columns show the images from wells treated with just DMSO (control), cytochalasin D, and Colchicine. Notice that the morphology of each marker is different in the presence of each drug. Interestingly, there is an effect in the morphology of the chromatin in the Hoechst image of cytochalasin D, which effects the actin cytoskeleton (and thus there is an expected effect in the phalloidin image). Also, there is an effect on the actin cytoskeleton, compared to control, in the presence of colchicine that effects the microtubule network.

The low magnification images were analyzed as described in the first experiment, and different patterns were seen in both the average gray value vs. area plots, and in the number of cells per well (data not shown). Based upon the results of this experiment, it can be concluded that the fact that changes in patterns of a marker that is "down-stream" from the mechanism of action of a compound are detectable illustrates the efficacy of this approach.

The next step based upon the results of this experiment is to develop automated image analysis protocols for actin and other markers.

A fifth experiment was performed to test quadruple labeling of 9 different cell lines grown in normal conditions. In this experiment, NCI-H460, A549, MDA-MD-

231, MCF-7, SK-OV-3, OVCAR-3, A498, U-2 OS, and HeLa cells were plated. Then, the cells were fixed and stained for DNA, tubulin, actin, and Golgi markers.

The following table summarizes the procedures for this experiment:

Action	Active Ingredient/Notes	Buffer	Vol/ well	Desired Time	Temp
Remove media	NOTE: gently by pipetting, not aspiration				
Fix	4% Formaldehyde	PBS	100µl	20 min	rt
Wash		TBS	100µl	5 min	rt
Wash		TBS	100µl	5 min	rt
Permeablize	0.1% Triton X-100	TBS	100µl	10 min	rt
Permeablize	0.1% Triton X-100	TBS	100µl	10 min	rt
Block	% BSA % Serum Filter sterilize before use	TBS w/azide	100µl	1hr or o/n	rt or 4°C
Primary Antibody	1:1000 dilution of DM1α	TBS + 1% BSA + 0.1% TX-100	50µl	1hr or o/n	rt or 4°C
Wash		TBS	100µl	5 min	rt
Wash		TBS	100µl	5 min	rt
Wash		TBS	100µl	5 min	rt
Fluorescent Stain	FITC lens culinaris 1:500 Rhodamine-Phalloidin 1:500 CY5 goat anti-mouse 1:100	TBS + 1% BSA + 0.1% TX-100	50µl	1 hr.	rt, dark
Wash		PBS	100µl	5 min	rt, dark
Hoechst	1:1000 dilution of 5mg/ml	TBS	100µl	15 min	rt, dark
Wash		PBS	100µl	5 min	rt, dark
Wash		PBS	100µl	5 min	rt, dark
Wash		PBS	100µl	5 min	rt, dark
Store		PBS	200µl	1 month	4°C

Cells were plated out at different densities for 48 hours. Cells were fixed and labeled by the above method. Cells were imaged using an automated imaging macro that collected 9 images from each marker using a 10x objective. Higher magnification images were collected of a few cells for demonstration purposes.

In this experiment, each cell line demonstrated different morphological patterns as determined by phase. For example, A549 cells are much more compacted than OVCAR-3 cells as determined by phase contract imaging (data not shown). The different fluorescent markers showed even bigger differences between different cell lines. Figs. 8 and 9 show 4 panels of each marker for A549 (Fig. 8) and OVCAR-3 cells (Fig. 9). The markers are Hoechst (upper left), Phalloidin (upper right), Lens culinaris (lower left), and DM1a antibody (lower right). The following table summarizes the qualitative differences between these images:

Marker	A549	OVCAR3
Hoechst/DNA	small	large
Phalloidin/actin	fuzzy	crisp - many stress fibers
Lens culinaris/Golgi	compact	Disperse/punctate
DM1alpha/Tubulin	perinuclear	evenly distributed

Higher magnification images were taken of the OVCAR3 cells. Fig. 10 shows the same markers at 20x, and Fig. 11 shows the markers at 40x. While the highest magnification images show the most detail, these images illustrate that very little morphological information is lost in the 10x images.

These data exemplify the differences in morphology seen between different cell types. Thus the automated image analysis software will have to be customized for each marker in each cell type. Different drugs should effect these morphologies differentially.

The next steps based upon the results of this experiment are to customize and develop an automated quantification for each marker and cell line.

A sixth experiment was conducted with a more sophisticated software package and to develop more flexible image recognition algorithms. In this experiment, prototype image features extraction was performed using Matlab programming language with image toolbox and SDC morphology toolboxes. Algorithms are being developed that will automatically identify objects on images and to measure various morphological and intensity parameters of these objects. Since at present it is not known which of the measurements will be most useful for subsequent clustering, many different measurements for each of the cellular markers were acquired.

An example of a MatLab program called "AnalyseDNA" that takes as an input an unlimited number of images, identifies individual objects in these images based on either their intensities, or based on edge-detection algorithms, and extracts a number of morphological and intensity characteristics of these objects is provided in a particular embodiment according to the present invention. It will be understood that other programs could also be used in other embodiments without departing from the scope of the present invention. Thus, the copy of this program reproduced below is intended to be representative but not limiting:

**Listing of the AnalyseDNA.m program and of some of the  
supporting subroutines**

```
function files_analysed = AnalyseDNA(filemask, outpath, nx,
ny, filter_range, dext, modifier, sfname)
% AnalyseDNA performs measurements on files of DNA images
% V1. EV 2-11-99; 2-15-99; 2-16-99
%
% files_analysed = AnalyseDNA(filemask, outpath, nx, ny,
filter_range, dext, modifier, sfname)
%
% PARAMETERS:
%   ALL PARAMETERS ARE OPTIONAL
%
%   FILEMASK - mask for file names to be analyzed
INCLUDING PATH(for example c:\images\*.tif)
%   DEFAULT '*.tif' (all *.tif files in the current
directory).
%
%   OUTPATH - path to a directory where all the output
files will be placed.
%   DEFAULT - output is saved in the same directory which
contains images
%
%   NX, NY - number of individual images in montage images
along X and Y axes (DEFAULT 1)
%
%   FILTER_RANGE - 3 col-wide array (or []). Specifies how
data is filtered when summary is calculated
%   this parameter internally is passed to GetDNAData and
then to GetSummaryData - see these
%   functions for details. For example: [2 2 Inf; 6 100
8000] will case all rows of data for which
%       values in column 2 are less than 2 and all rows
where values in column 6 are less than 100 or
%       more than 8000 to be excluded from all
calculations of a summary.
%   DEFAULT - [] (means do not filter, summarize all data)
%
%   DEXT - string. Extension for data files being saved.
%   DEFAULT 'dat';
%
%   MODIFIER - this modifier is 'SUMMARY', summary file is
created;
%       'SUMMARY ONLY' - only summary is generated, data
for individual files are not saved
%
%   sfname - string. File name of a summary file
```

```

%   DEFAULT 'summary[date].dat'
%
% OUTPUT:
%
%   AnalysedDNA works on image files or montages. For each
image file it creates a tab-delimits file of measured
%   parameters of all the objects in the montage with the
same base name as a montage file and extension specified
%   by dext parameter (or .dat by default) and file
'errors[date].err' - with the list of files that matched the
%   filemask but could not be processed.
%   If 'summary' or 'summary only' modifier is specified,
it also creates a single file 'summary[date].dat' (or
%   different extension, if specified by DEXT) which
contains summary information for all analyzed files.
%
%   ALL OUTPUT FILES are saved in a directory specified by
OUTPATH parameter
%
%   RETURNS *files_analysed* - number of files that have
been successfully processed.
%
%   Column designations in the output files are described
in GetDNADData
%
% FILE NAME CONVENTIONS
%   AnalysedDNA attempts to identify a number for each file
to identify the file in summary output.
%   It does that by looking for the first space or
underscore, followed by a number and then takes
%   as many successive numbers as it can find. If it fails
to identify a number it assigns a
%   default which is -1
%
%
% SEE ALSO GetDNADData, GetSummaryData
%
% TO DO   improve error handling in opening and writing
files (GLOBAL error_file ?)
%         include procedures for writing text headers into
the output files

if nargin > 8
    error ('Wrong number of input parameters');
end
if nargout >1
    error ('Wrong number of output parameters: only one
allowed');
end

% set defaults

```



```

need_summary = 0;
summary_only = 0;
use_default_outpath = 0;
datestring = datestr(floor(now));
if nargin == 7 % set default summary file name
    sfname = ['summary' deblank(datestring)]; % extension
will be appended later based on dext
    if deblank(upper(modifier)) == 'SUMMARY'
        need_summary = 1;
    elseif deblank(upper(modifier)) == 'SUMMARY ONLY'
        need_summary = 1;
        summary_only = 1;
    else
        error(['Wrong parameter: unknown modifier '
modifier]);
    end
end

if nargin == 5
    % default data file extension
    set dext = 'dat';
end
if nargin == 4
    % default filter range
    filter_range = [];
end
if nargin == 3
    ny = 1; % default number of images in montage along Y
end
if nargin == 2
    nx = 1;
end
if nargin == 1
    use_default_outpath = 1;
end
if nargin == 0
    filemask = '*.tif'
end

% check parameters
if ( ~ischar(filemask) | ~ischar(dext) | ~ischar(sfname) )
    error('Wrong parameter type: filename, filepath,
dext and sfname should be strings');
end
if ( ( size(nx) ~= [1 1] ) | ( size(ny) ~= [1 1] ) )
    error('Wrong parameter type: nx and ny should be scalars
(1x1 arrays)');
end
if (~isempty(filter_range) & size(filter_range, 2) ~= 3)
    error('Wrong parameter type: filter range should be []
or 3 - cols-wide array');
end

```

```

end
% end testing parameters

% Generate list of files to process

datapath = getpath(filemask);
if use_default_outpath == 1
    outpath = datapath;
end
if exist(outpath, 'dir') ~= 7
    error(['Path ' outpath, 'not found. Exiting..']);
elseif exist(datapath, 'dir') ~= 7
    error(['Path ' datapath, 'not found. Exiting..']);
end

sfname = makefullname(outpath, sfname, dext);
if need_summary == 1
    if exist(sfname, 'file')
        disp(['File ', sfname, 'already exists!']);
        input ('Press ^C to abort, Enter to delete and
continue');
        delete(sfname);
    end
end

flist = FileList(getfname(filemask), datapath);
numfiles = size(flist, 1); % total number of files to
process
disp(['About to process ', num2str(numfiles), ' files']);
%DEBUG - commented out "input" to run from Wrod
input('Press ^C to abort, Enter to continue');

% main loop where the job gets done:
error_file = makefullname(outpath, ['error' datestring
'.err']);
num_processed = 0;
num_error = 0;
for i = 1:numfiles
    % first generate file name for a data output file
    current_fullname = flist(i, :); % full name with path and
extension
    current_datafile = makefullname(outpath,
makefname(getbasefname(current_fullname), dext) );

    %extract number from a filename
    fnumber = getfilenumber(current_fullname);

    % load an imagefile, record errors
    read_error = 0;
    try

```

```

        I = imread(current_fullname);
        %DEBUG
        disp(['Image file #', num2str(fnumber), ' loaded']);
    catch
        % record file-opening error in an error_file
        read_error = 1;
        num_error = num_error + 1;
        msg = [current_fullname ': ' lasterr];
        add_error_msg(error_file, msg);
    end

    % extract and write data to a file in outpath
    if read_error ~= 1
        if (need_summary == 0)
            %DEBUG
            disp(['Starting analysis of file #',
num2str(fnumber), '.']);
            current_data = GetDNADData(I, nx, ny, fnumber);
            %DEBUG
            disp(['Finished analysis of file #',
num2str(fnumber), '.']);
            %load current_data.mat 'current_data';
            write_data(current_data, current_datafile);
        else %summary needed
            %DEBUG
            [current_data, current_summary] = GetDNADData(I, nx,
ny, fnumber, filter_range);
            %load current_data.mat 'current_data';
            %load current_summary.mat 'current_summary';
            write_summary(current_summary, sfname);
            if summary_only ~= 1
                write_data(current_data, current_datafile);
            end
        end
    end
end
end % of the main for loop
num_processed = numfiles - num_error;

%=====end function AnalyseDNA()
=====

%=====
=====
function result = add_error_msg(filename, msg)
% adds string MSG to an errorfile FILENAME
% returns 1 if success, 0 if failure

err_FID = fopen(filename, 'at');
if err_FID == -1
    warning(['Can not open error file ' filename]);
else

```

```

        fprintf(err_FID, '%s\n', msg);
        fclose(err_FID);
    end
    %=====end function add_error_masg()
    =====

    %=====
    =====
    function N = getfilenumber(fname)
    % returns the first number extracted from a file name
    (string) or -1 if fails to extract any number
    numbers = NumbersFromString( getfname(fname) ); % vector of
    all numbers encoded in the name

    % (but not in the path, even if present)
    if isempty(numbers)
        N = (-1); % return -1 if no numbers found in the name
    else
        N = numbers(1);
    end

    %===== end function getfilenumber()
    =====

    %=====
    =====
    function result = write_data(data_array, file_name)
    % writes data in a data_array in a tab-delimited ascii file.
    % result is 0 if success and -1 if failure
    % if file_name exists, overwrites it
    result = -1;
    try
        fid = fopen(file_name, 'wt');
        if fid ~= -1
            for k = 1:size(data_array, 1)
                fprintf(fid, '%g\t', data_array(k, :));
                fprintf (fid, '\n');
            end
            test = fclose(fid);
            result = -1;
        end
    catch
        result = -1;
    end

    %===== end function write_data()
    =====

    %=====
    =====
    function result = write_summary (s_vector, file_name)

```

```

% appends summary vector s_vector to a file_name (ASCII tab-
delimited file).
% if file_name does not exist, creates it.
% result is 0 if success and -1 if failure
%
result = -1;
try
    % debug
    fid = fopen(file_name, 'at');
    result = fprintf(fid, '%g\t', s_vector);
    result = fprintf(fid, '\n');
    result = fclose(fid);
    result = 0;
catch
    result = -1;
end

% ===== end function write_summary()
=====

function Data = GetObjectsData(I, Ilabel)
% GetObjectsData returns array measurements of objects in
image "I" masked by "Ilabel"
% EV 2-3-99; 2-10-99
% OData = GetObjectsData(I, Ilabel) returns an array of
morphological and intensity measurements
%   taken from a grayscale image "I". Objects are
identified on a mask image Ilabel, usually
%   created by bwlable()
% OUTPUT:
% Each row in the output array OData represents individual
object
% columns contain the following measurements:
%
%   1 - Index ("number" of an object);      8 - Solidity;
%   2 - X coordinate of the center of mass; 9 - Extent;
%   3 - Y coordinate      "-"      ; 10 - Total
Intensity;
%   4 - Total Area (in pixels);              11 - Avg.
Intensity;
%   5 - Ratio of MajorAxis/MinorAxis;        12 - Median
Intensity;
%   6 - Eccentricity;                        13 - Intensity of
20% bright pixel
%   7 - EquivDiameter;                       14 - Intensity of
80% bright pixel
%
% For details on morphological parameters see information on
MatLab imfeature();
% Intensity parameters are either obvious or are documented
in comments in this file.

```

```

% Procedures in this file are documented in notebook file
"MATLAB Measuring Nuclei (1) 1-29-98.doc"

if (nargin ~= 2)
    error ('function requires exactly 2 parameters');
end
if (nargout ~= 1)
    error ('function has 1 output argument (array X by 14)');
end

% finished checking arguments

% first collect morphological parameters in a structure
array:
ImStats = imfeature(Ilabel, 'Area', 'Centroid',
'MajorAxisLength',...
    'MinorAxisLength', 'Eccentricity', 'EquivDiameter', ...
    'Solidity', 'Extent', 8 );

% now convert it into array (matrix) while collecting
intensity data for each object:

%preallocate output array:
numobjects = size(ImStats, 1);
OData = zeros(numobjects, 14);
%now convert ImStats into array and add intensity data to it
for k=1:numobjects
    OData(k, 1) = k;
    OData(k, 2) = ImStats(k).Centroid(1);
    OData(k, 3) = ImStats(k).Centroid(2);
    OData(k, 4) = ImStats(k).Area;
    OData(k, 5) = (ImStats(k).MajorAxisLength) /
(ImStats(k).MinorAxisLength);
    OData(k, 6) = ImStats(k).Eccentricity ;
    OData(k, 7) = ImStats(k).EquivDiameter;
    OData(k, 8) = ImStats(k).Solidity;
    OData(k, 9) = ImStats(k).Extent;

    % now collect and assign intensity parameters from
image I

    object_pixels = find( Ilabel == k);
    object_area = size(object_pixels, 1); %same as total
number of pixels in the object
    object_intensities = double(I(object_pixels)); % need
to convert to double to do math
    sorted_intensities = sort(object_intensities); % will
need to get median, 20% and 80% pixels
    total_intensity = sum(object_intensities, 1);
    avg_intensity = total_intensity / object_area;

```

```

        median_intensity = sorted_intensities( floor(
object_area/2 ) + 1 );
        pix20 = sorted_intensities( floor(object_area*0.2)+1 )
; %brightest pixel among dimmest 20%
        pix80 = sorted_intensities( floor(object_area*0.8)+1 )
;

        OData(k, 10) = total_intensity;
        OData(k, 11) = avg_intensity;
        OData(k, 12) = median_intensity;
        OData(k, 13) = pix20; %brightest pixel among dimmest
20%
        OData(k, 14) = pix80; %dimmest pixel among brightest
20%
    end %for

%===== end function
GetObjectsData()=====

```

```

function Imask = MaskDNA1(I);
% MaskDNA1 - generates binary mask for cell nuclei through
edge detection
% EV 1-22-99; 2-6-99; 2-10-99
% Imask = MaskDNA1(I)
% PARAMETERS
%     I - intensity image (grayscale)
% OUTPUT
%     Imask - BW image with objects from I
%
% For more details see Notebook Matlab_DNA_masking1_1-22-
99.doc
% Uses SDC Morphology Toolbox V0.7

```

```

if (nargin ~= 1)
    error('Wrong number of input parameters');
end
if (nargout ~= 1)
    error('Wrong number of output parameters: one output
argument should be provided');
end

```

```

Imask = edge(I, 'canny');
Imask = mm dil(Imask, mmsecross(1));
Imask = mm ero ( mmc lohole(Imask,mmsecross(1)));
Imask = mm edgeoff(Imask, mmsecross(1));
% note that mmedgeoff this command removed FILLED OBJECTS
but not touching OUTLINES.
% these outlines can be removed by filtering:
Imask = medfilt2(Imask, [5 5]);

```

%=====end MaskDNA1 =====

Given the list of image files or montages of images as an input, this program creates an individual file for each image that contains the following quantitative measurements for all objects identified in the image:

- |   |                                    |
|---|------------------------------------|
| 1 - Index ("number" of an object);      | 8 - Solidity;                      |
| 2 - X coordinate of the center of mass; | 9 - Extent;                        |
| 3 - Y coordinate        "-        ";    | 10 - Total Intensity;              |
| 4 - Total Area (in pixels);             | 11 - Avg. Intensity;               |
| 5 - Ratio of MajorAxis/MinorAxis;       | 12 - Median Intensity;             |
| 6 - Eccentricity;                       | 13 - Intensity of 20% bright pixel |
| 7 - EquivDiameter;                      | 14 - Intensity of 80% bright pixel |

A fragment of an output for a single file, containing 9 images of cells stained for DNA and acquired with a 10x lens, is provided in a particular embodiment according to the present invention. It will be understood that other results could also be obtained in other embodiments without departing from the scope of the present invention. Thus, the copy of this example output file reproduced in Appendix A is intended to be representative but not limiting.

A montage image that was used as a source to generate data in Appendix A is presented in Fig. 12. The same program also summarizes measurements across many files and performs statistical analysis of the summary data. It creates a summary file with the following data:

- |   |                                    |
|---|------------------------------------|
| 1 - Image file number;                    |                                    |
| 2 - Average object Area (in pixels);      | 3 - STD (standard deviation) of 2; |
| 4 - Avg. of Ratio of MajorAxis/MinorAxis; | 5 - STD of 4;                      |
| 6 - Avg. Eccentricity;                    | 7 - STD of 6;                      |
| 8 - Avg. EquivDiameter;                   | 9 - STD of 8;                      |
| 10 - Avg. of Solidity;                    | 11 - STD of 10;                    |



12 - Avg. of Extent;	13 - STD of 11
14 - Avg. of objects Total Intensity;	15 - STD of 14
16 - Avg. of objects Avg Intensity;	16 - STD of 15
18 - Avg. of objects Median intensity;	19 - STD of 18
20 - Avg. of objects intensity of 20% bright pixel;	21 - STD of 19
22 - Avg. of objects intensity of 80% bright pixel;	23 - STD of 21

An example of summary output obtained by running AnalyseDNA against 10 montage files is provided in a particular embodiment according to the present invention. It will be understood that other results could also be obtained in other embodiments without departing from the scope of the present invention. Thus, the copy of this example output file reproduced in Appendix B is intended to be representative but not limiting.

A seventh experiment was conducted in order to use sequence analysis algorithms to analyze features of cell images. In this experiment, HeLa cells were treated for 24 hour with several different compounds, fixed, and stained with a fluorescent DNA dye. One image of these cells was acquired for each of the treatments and following morphometric parameters were measured:

Resulting measurements were arranged into a string of numbers and reduced to a pseudo- nucleic acid sequence using following rules: At any given position in the sequence a number was substituted by "t" (a code for thymidine) if its value is among highest 25% of the values at the corresponding position in the data set, "g" if it is between 50% and 25%, "c" if it is between 75% and 50%, and "a" if it belongs to lowest 25% of values. Thus one sequence was generated per treatment as illustrated in Fig. 13.

Resulting sequences were clustered using an AlignX module commercial software package Vector NTI (<http://informaxinc.com>), which uses a Neighbor Joining algorithm for sequence clustering.

Resulting dendrogram is presented in Fig. 13. On the dendrogram the closest "leafs" correspond to the closest pseudo-sequences. Interestingly, compounds with similar mechanisms of action cluster together on the dendrogram. Another example of the generation of pseudo-sequences and clustering is shown in Fig. 14.

## CONCLUSION

Although the above has generally described the present invention according to specific computer based software and systems, the present invention has a much broader range of applicability. In particular, the present invention is not limited to a particular kind of data about a cell, but can be applied to virtually any cellular data where an understanding about the workings of the cell is desired. Thus, in some embodiments, the techniques of the present invention could provide information about many different types of cells, substances, and genetic processes of all kinds. Of course, one of ordinary skill in the art would recognize other variations, modifications, and alternatives.

## APPENDIX

Data derived from select embodiments has been attached as a paper appendix, the entire contents of which is incorporated herein by reference for all purposes

WHAT IS CLAIMED IS:

1                   1.     A computer program product for populating a database with  
2 manipulated biological information, said computer program product comprising:  
3                   code for providing a plurality of cells in various stages of the cell cycle,  
4 said stages of the cell cycle including at least one selected from interphase, G0 phase, G1  
5 phase, S phase, G2 phase, M phase, prophase, prometaphase, metaphase, anaphase, and  
6 telophase;  
7                   code for manipulating said cells in said various stages of cell cycle  
8 development to form a plurality of manipulated cells;  
9                   code for capturing an image of said plurality of manipulated cells;  
10                  code for determining a descriptor from said image for said manipulated  
11 cells;  
12                  code for populating a database with said descriptor;  
13                  wherein said image includes a first component of a cell and a second  
14 component of said cell; and  
15                  a computer readable storage medium for holding the codes.

1                   2.     The computer program product of claim 1 wherein said first  
2 component and said second component are selected from a protein, a protein  
3 modification, a nucleic acid, a lipid, a carbohydrate, a sub-cellular structure and an  
4 organelle.

1                   3.     The computer program product of claim 1 wherein said image is a  
2 digitized representation of said plurality of manipulated cells.

1                   4.     The computer program product of claim 3 wherein said digitized  
2 representation provides a density value of said plurality of manipulated cells.

1                   5.     The computer program product of claim 1 wherein said descriptors  
2 comprise numeric or logical values.

1                   6.     The computer program product of claim 5 wherein said values  
2 further comprises a nucleotide.

1                   6.       The computer program product of claim 5 wherein said values  
2 further comprises an amino acid letter.

1                   8.       A computer program product for determining a property of a  
2 manipulation based upon effects of said manipulation on at least two of a plurality of  
3 components of at least one of a plurality of cells, said computer program product  
4 comprising:

5                         code for providing at least one of a plurality of samples of said  
6 manipulation to said at least one of a plurality of cells;

7                         code for determining at least one of a plurality of features of said at least  
8 two of a plurality of components of at least one of a plurality of cells in the presence of  
9 said manipulation;

10                        code for determining at least one of a plurality of descriptors, said  
11 descriptors comprising at least one of said plurality of features;

12                        code for searching a plurality of descriptors obtained from a database to  
13 locate descriptors based upon one of said descriptors of said manipulation, said searching  
14 forming a plurality of located descriptors;

15                        code for determining, based upon said located descriptors, properties of  
16 said manipulation based upon said located descriptors;

17                        wherein said two of a plurality of components includes a first component  
18 and a second component of a cell, said code for determining at least one of a plurality of  
19 descriptors of a state comprises code for combining information about said first  
20 component and said second component; and

21                        a computer readable storage medium for holding the codes.

1                   9.       The computer program product of claim 8 wherein said plurality of  
2 components are selected from a protein, a protein modification, a nucleic acid, a lipid, a  
3 carbohydrate, a sub-cellular structure and an organelle.

1                   10.     The computer program product of claim 8 wherein said code for  
2 determining said plurality of located descriptors further comprises code for determining a  
3 plurality of matching descriptors, said matching descriptors corresponding to a prior  
4 administration of said manipulation, said prior administration of said manipulation having  
5 at least one of a plurality of properties.

1                   11.     The computer program product of claim 8 wherein said code for  
2     providing a manipulation comprises code for applying a chemical factor.

1                   12.     The computer program product of claim 8 wherein said code for  
2     providing a manipulation comprises code for applying a biological factor.

1                   13.     The computer program product of claim 8 wherein said code for  
2     providing a manipulation comprises code for applying an electromagnetic factor.

1                   14.     The computer program product of claim 8 wherein said code for  
2     providing a manipulation comprises code for applying a gravitational factor.

1                   15.     The computer program product of claim 8 wherein said code for  
2     providing a manipulation comprises code for applying a mechanical factor.

1                   16.     The computer program product of claim 8 wherein said code for  
2     providing a manipulation comprises code for applying a thermal factor.

1                   17.     The computer program product of claim 8 wherein said  
2     manipulation comprises a temporal factor.

1                   18.     The computer program product of claim 8 wherein said code for  
2     providing a manipulation comprises code for applying a nuclear factor.

1                   19.     The computer program product of claim 8 wherein said properties  
2     comprises toxicity.

1                   20.     The computer program product of claim 8 wherein said properties  
2     comprises specificity against a subset of tumors.

1                   21.     The computer program product of claim 8 wherein said properties  
2     comprises a mechanism of chemical activity.

1                   22.     The computer program product of claim 8 wherein said properties  
2     comprises a mechanism of biological activity.

1                   23.     The computer program product of claim 8 wherein said properties  
2     comprises a target protein.

1                   24.     The computer program product of claim 8 wherein said properties  
2 comprises a mechanism of action.

1                   25.     The computer program product of claim 8 wherein said properties  
2 comprises a structure.

1                   26.     The computer program product of claim 8 wherein said properties  
2 comprises at least one of a plurality of adverse biological effects.

1                   27.     The computer program product of claim 8 wherein said properties  
2 comprises at least one of a plurality of biological pathways.

1                   28.     The computer program product of claim 8 wherein said properties  
2 comprises at least one of a plurality of adverse clinical effects.

1                   29.     The computer program product of claim 8 wherein said properties  
2 comprises at least one of a plurality of cellular availability.

1                   30.     The computer program product of claim 8 wherein said properties  
2 comprises at least one of a plurality of pharmacological properties.

1                   31.     The computer program product of claim 8 wherein said properties  
2 comprises a gene expression profile.

1                   32.     The computer program product of claim 30 wherein said  
2 pharmacological properties comprises absorption.

1                   33.     The computer program product of claim 30 wherein said  
2 pharmacological properties comprises excretion.

1                   34.     The computer program product of claim 30 wherein said  
2 pharmacological properties comprises distribution.

1                   35.     The computer program product of claim 30 wherein said  
2 pharmacological properties comprises metabolism.

1                   36.     The computer program product of claim 8 wherein said properties  
2 comprises pharmacodynamic properties.

1                   37.     The computer program product of claim 8 wherein said properties  
2     can be selected from clinical uses and indications, human and veterinary diagnostic uses  
3     and tests, or human and veterinary prognostic uses and tests..

1                   38.     The computer program product of claim 8 wherein said descriptor  
2     comprises a scalar.

1                   39.     The computer program product of claim 8 wherein said descriptor  
2     comprises a vector.

1                   40.     A computer program product of mapping a manipulation of cells  
2     based upon a morphological value, said computer program product comprising:  
3                   code for capturing a morphological value from said plurality of cells said  
4     cells being manipulated;  
5                   code for assigning a degree of presence of said morphological value; and  
6                   code for storing said morphological value and said degree of presence;  
7                   wherein said morphological value is derived from a first component of a  
8     cell and a second component of said cell, said code for capturing said morphometric value  
9     from said plurality of cells comprises code for determining a relationship between said  
10    first component and said second component; and  
11                  a computer readable storage medium for holding the codes.

1                   41.     The computer program product of claim 40 wherein said first  
2     component and said second component are selected from a protein, a protein  
3     modification, a nucleic acid, a lipid, a carbohydrate, a subcellular structure and an  
4     organelle.

1                   42.     The computer program product of claim 40 wherein said  
2     manipulation occurs in a manner selected from a electrical source, a chemical source, a  
3     thermal source, a gravitational source, a nuclear source, a temporal source, and a  
4     biological source.

1                   43.     The computer program product of claim 42 wherein said chemical  
2     source is selected from a pharmacological candidate and a drug screening library.

44. The computer program product of claim 40 wherein said morphological value is selected from a count, an area, a perimeter, a length, a breadth, a fiber length, a fiber breadth, a shape factor, a elliptical form factor, an inner radius, an outer radius, a mean radius, an equivalent radius, an equivalent sphere volume, an equivalent prolate volume, an equivalent oblate volume, an equivalent sphere surface area, an average gray value, a total gray value, and an optical density.

1                    45.     The computer program product of claim 40 wherein said degree of  
2     presence is multiple of a quantized value.

46. A computer program product of predicting properties of an unknown compound based upon information about effects of at least one of a plurality of known compounds on a first cell population, said computer program product comprising:

- code for populating a database with descriptors for known compounds, wherein said descriptors are determined from imaging said first cell population;
- code for determining descriptors for cells subjected to the unknown compound, wherein said descriptors are determined from imaging a second cell population;
- code for determining a relationship between said descriptors of said unknown compound with said descriptors of said known compounds;
- code for making an inference about said unknown compound based upon said descriptors of said known compounds; and
- a computer readable storage medium for holding the codes.

1                   47.     The computer program product of claim 46 wherein said code for  
2     determining descriptors comprises code for determining a relationship between said first  
3     component and said second component.

1                    48.        The computer program product of claim 47 w herein said first  
2        component and said second component are selected from a protein, a protein  
3        modification, a nucleic acid, a lipid, a carbohydrate, a sub-cellular structure and an  
4        organelle.



**A DATABASE SYSTEM INCLUDING COMPUTER CODE FOR PREDICTIVE  
CELLULAR BIOINFORMATICS**

**ABSTRACT OF THE DISCLOSURE**

5 According to the present invention, computer based techniques for using  
information technology in therapeutics or drug discovery. In an exemplary embodiment,  
computer based techniques for determining information about the properties of substances  
based upon information about structure of living or non-living cells exposed to substances are  
provided. Computer software according to the present invention enables researchers and/or  
scientists to identify promising candidates in the search for new and better medicines or  
10 treatments using, for example, a cellular informatics database.

PA 183158 v1

SCANNED # 9

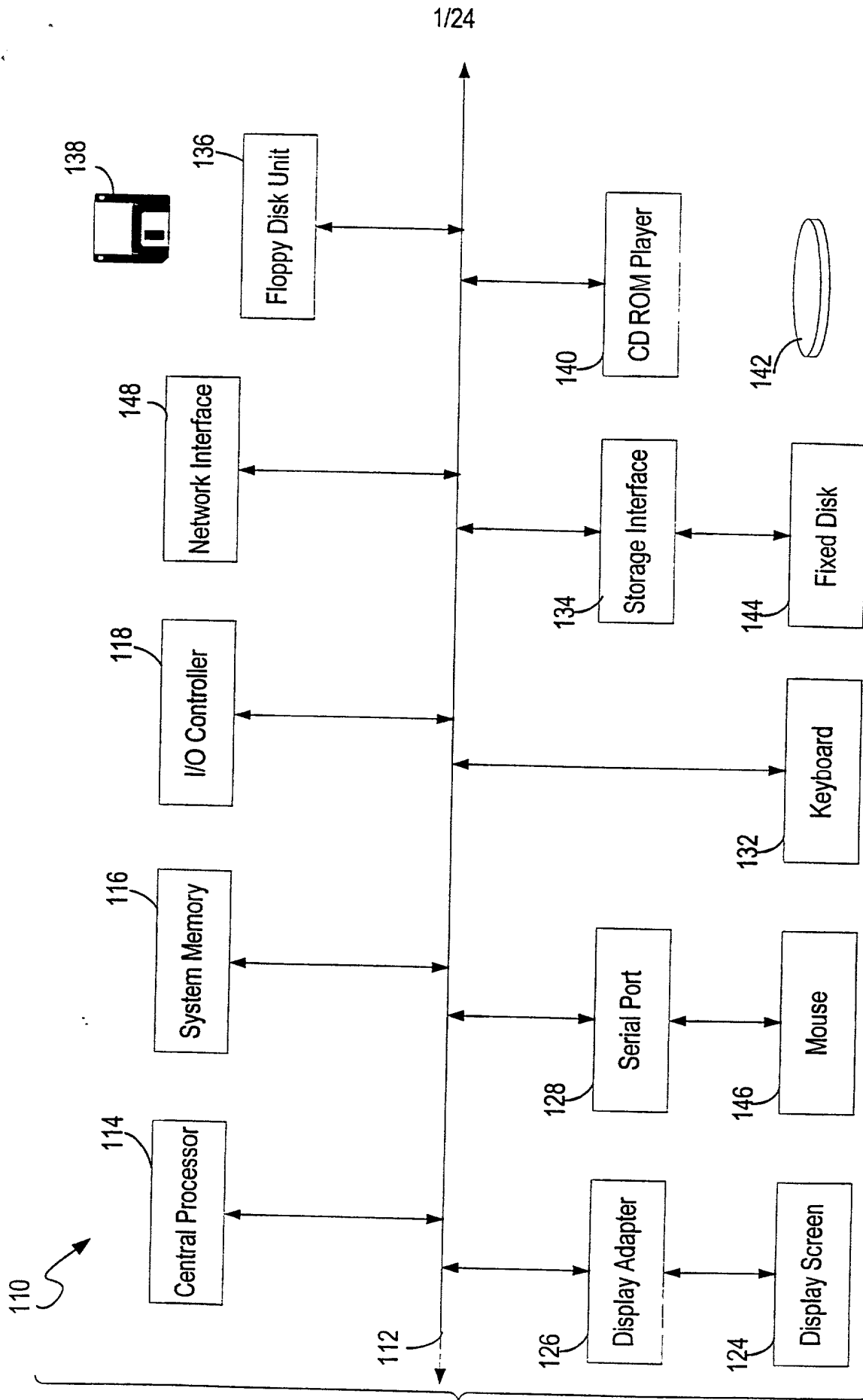


Fig. 1

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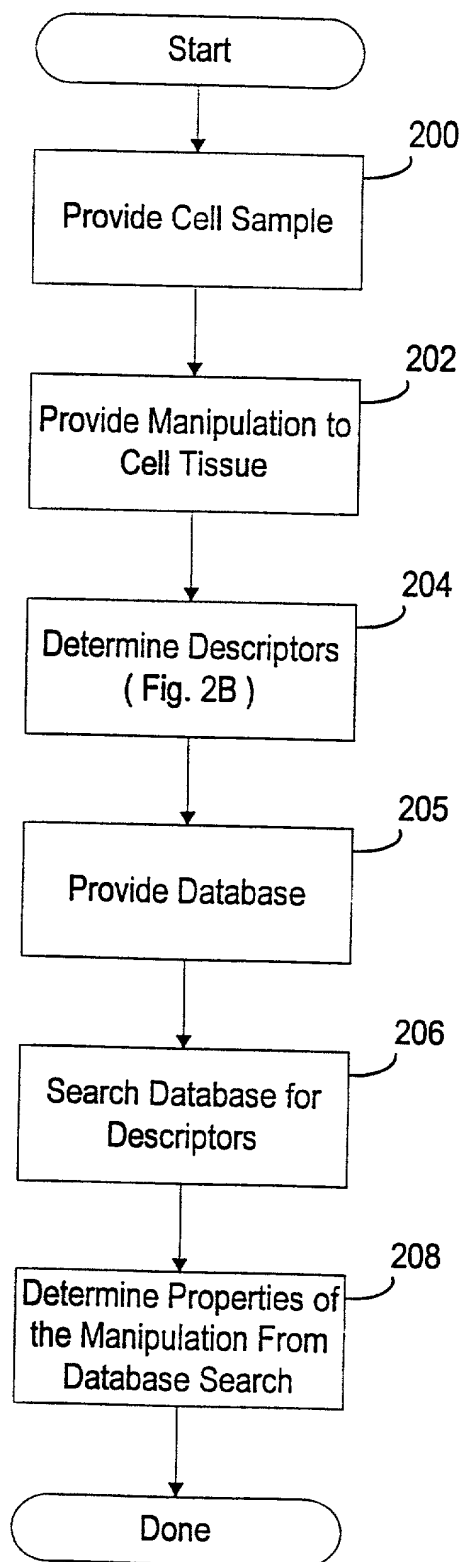


Fig. 2A

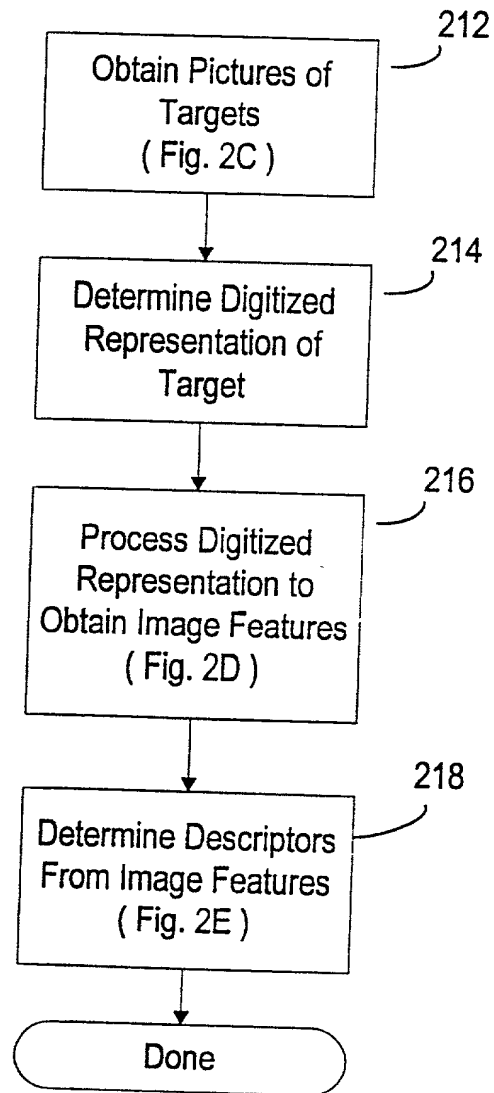


Fig. 2B  
Step 204 of Fig. 2A

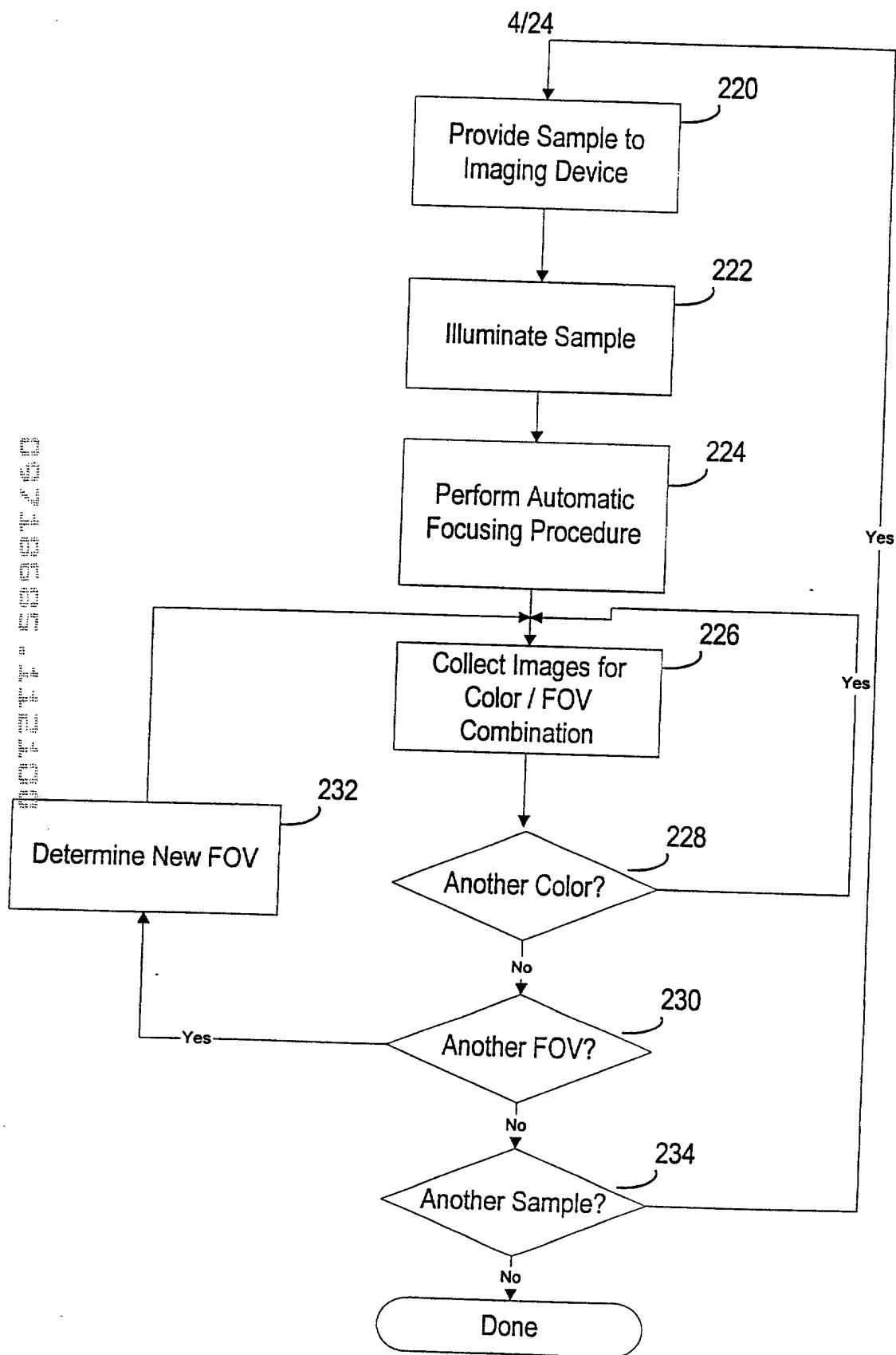


Fig. 2C  
Step 214 of Fig. 2B

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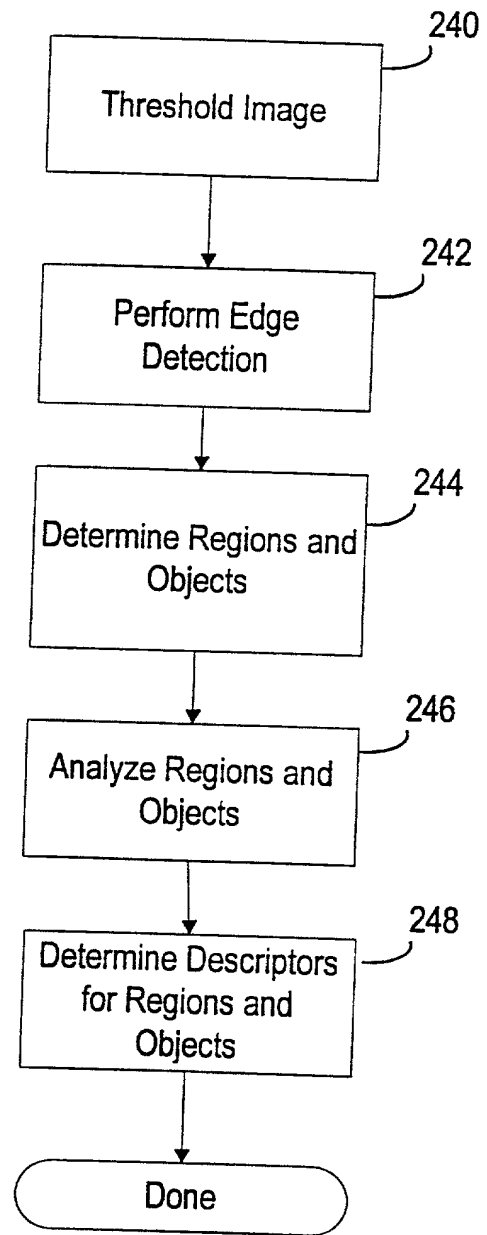


Fig. 2D  
Step 216 of Fig. 2B

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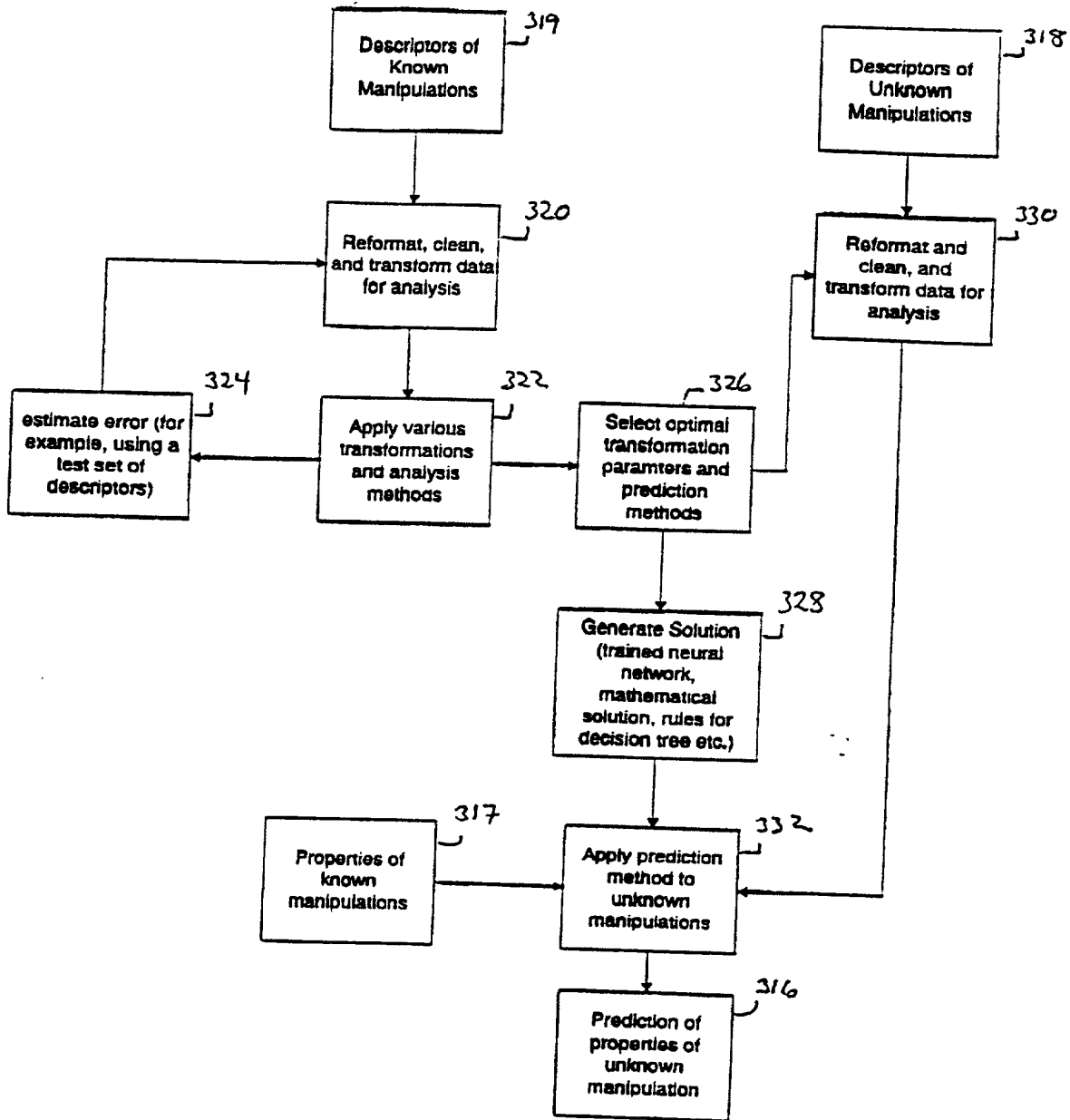


FIG 2E

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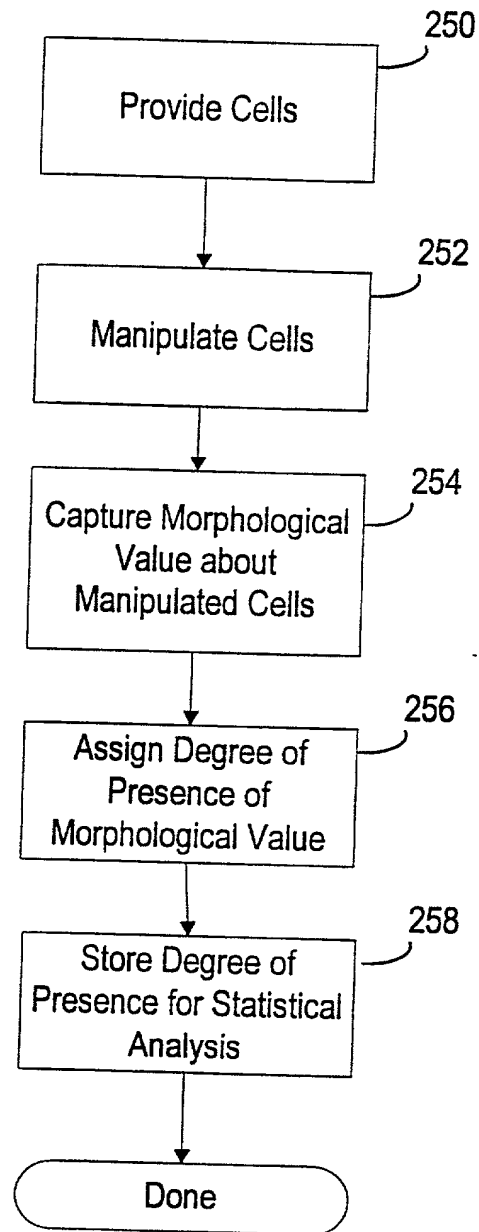


Fig. 2F



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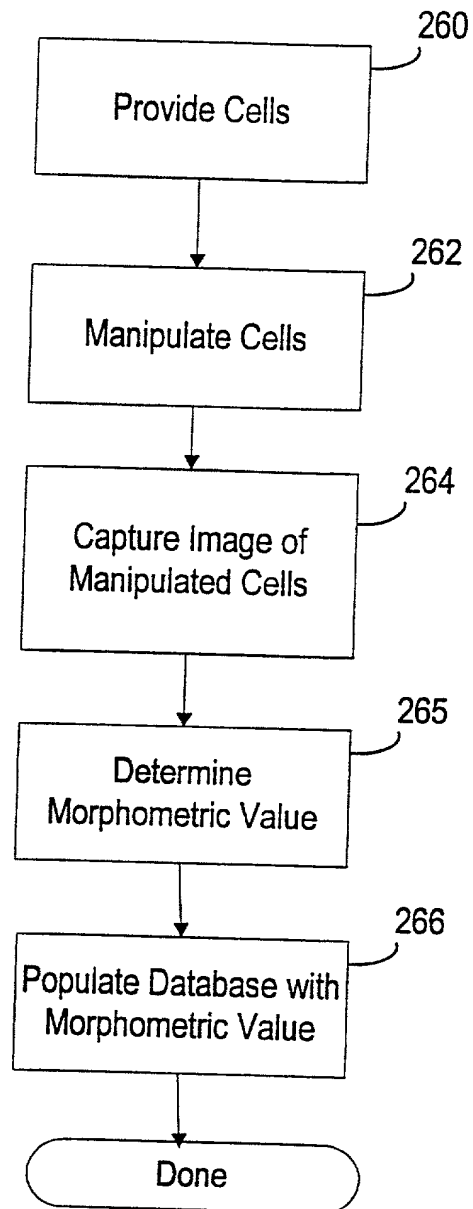


Fig. 2G

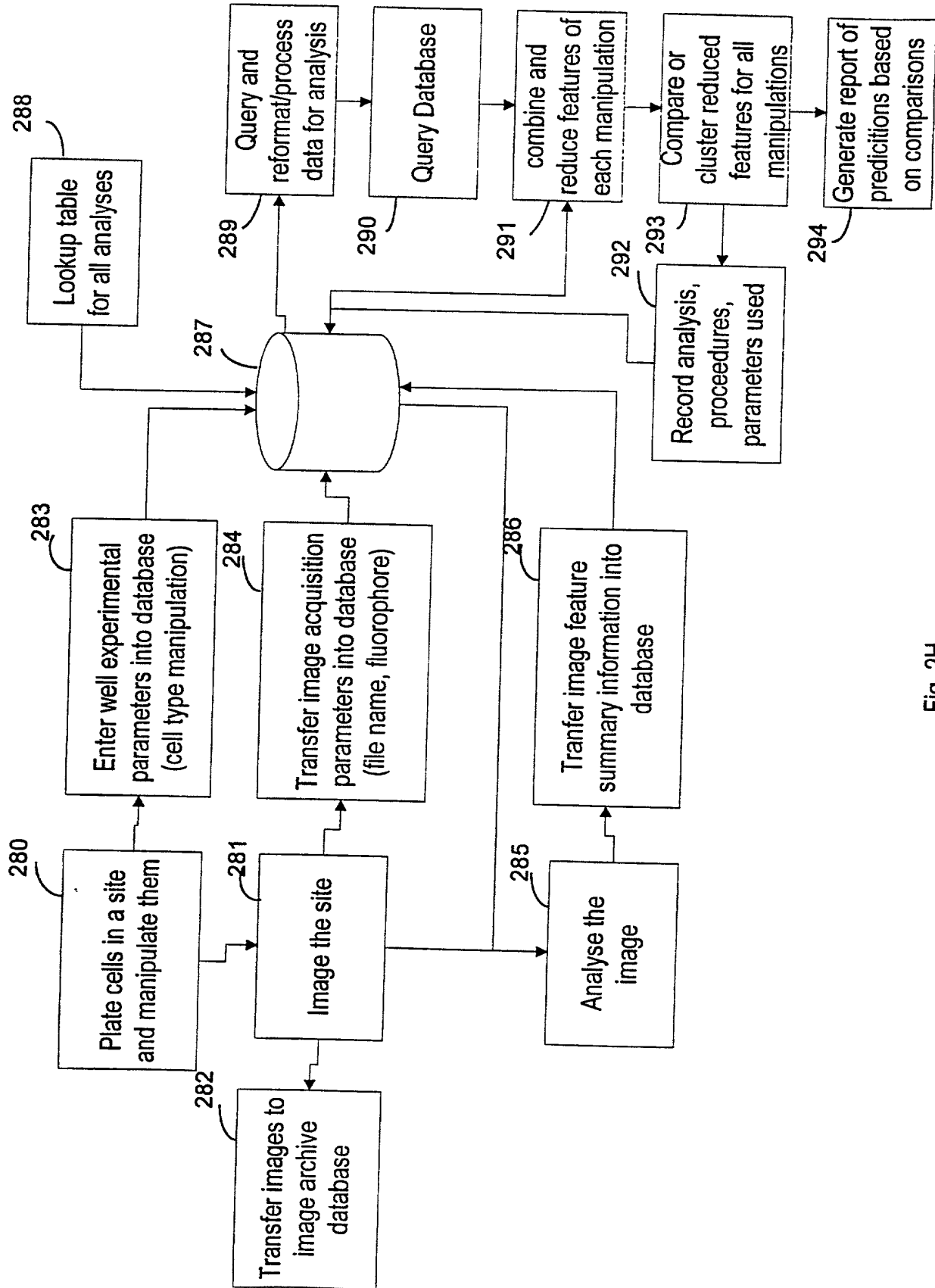


Fig. 2H

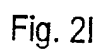


Fig. 21

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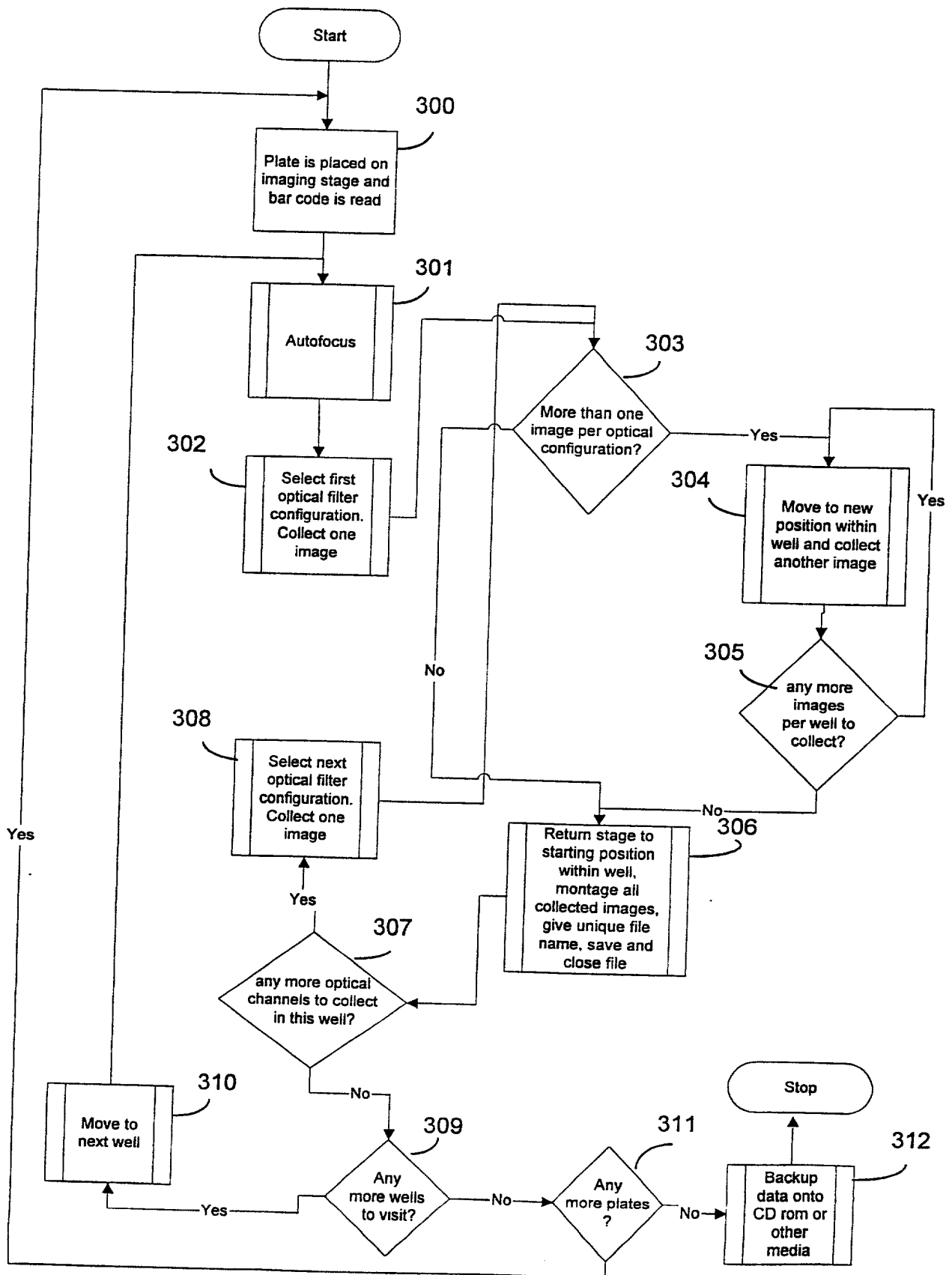


Fig. 2J

12/24

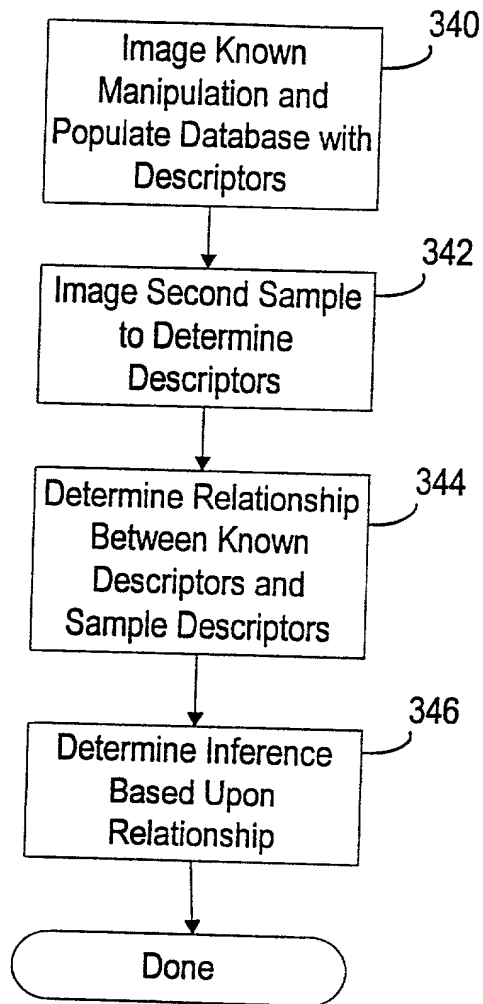


Fig. 2K

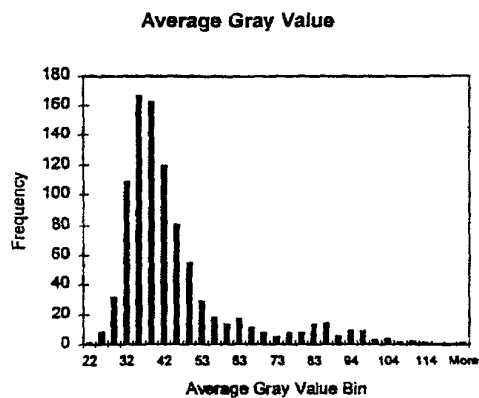


Fig. 3A

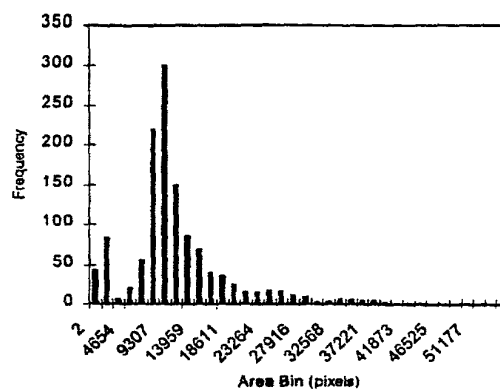


Fig. 3B

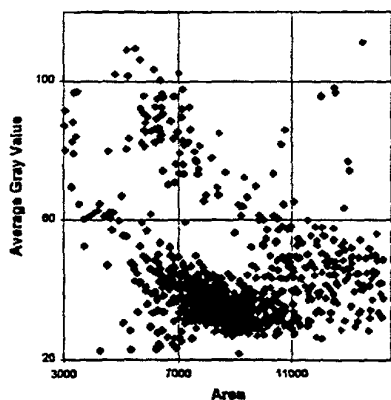


Fig. 3C

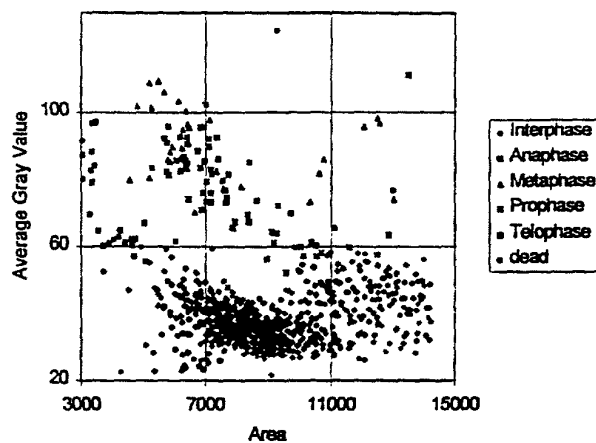


Fig. 3D

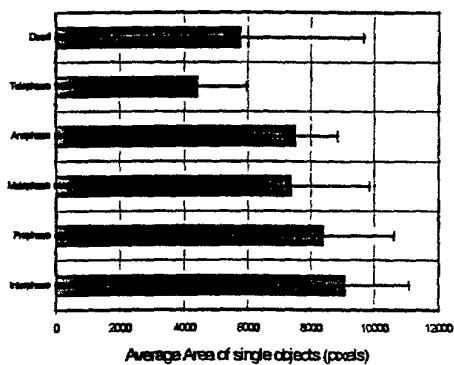


Fig. 3E

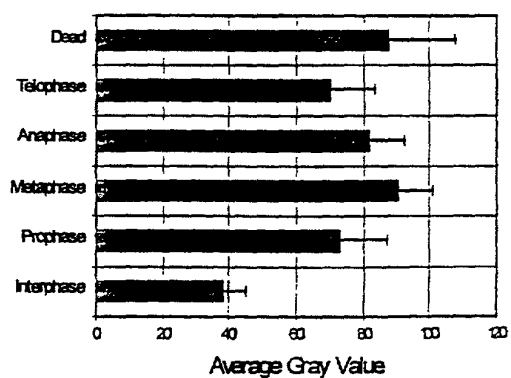
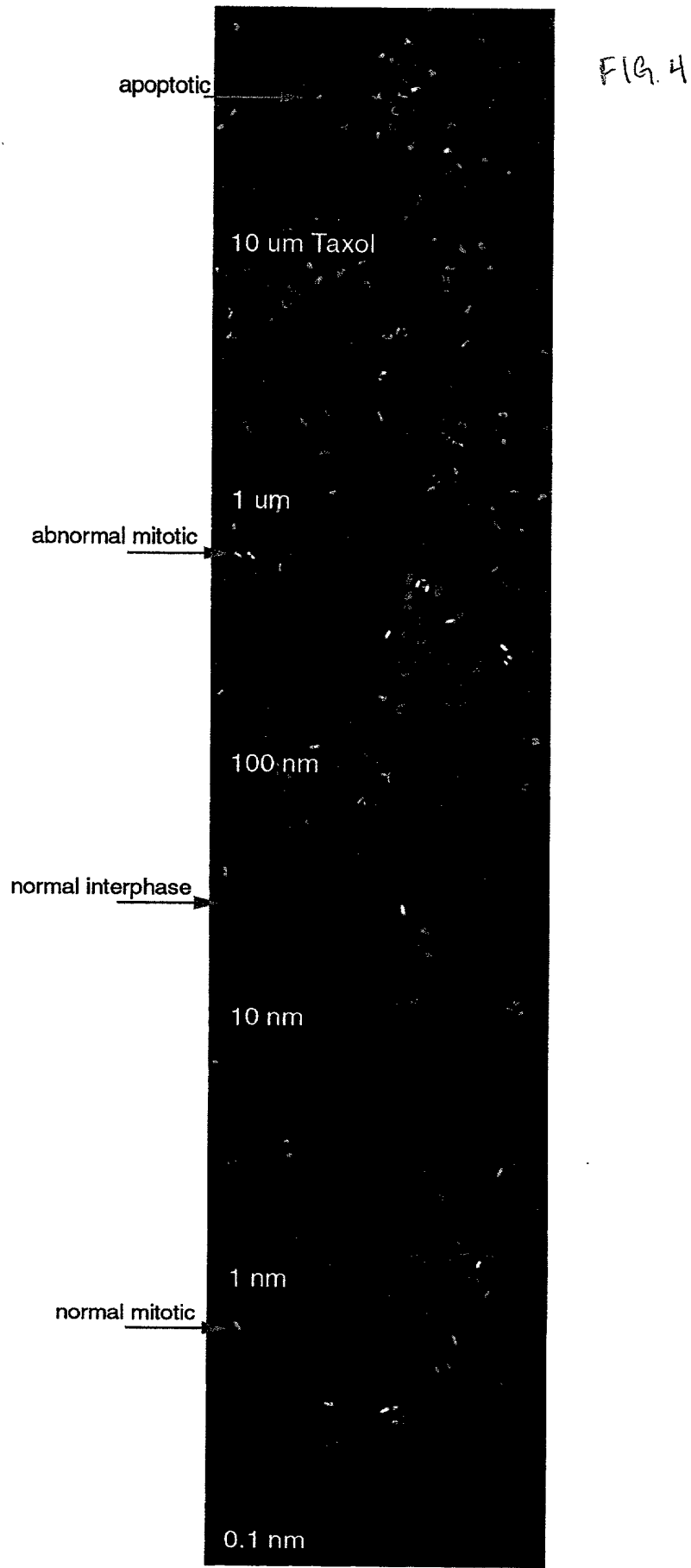


Fig. 3F

Figure 4



MDCK cells treated with Taxol for 4.5 hours

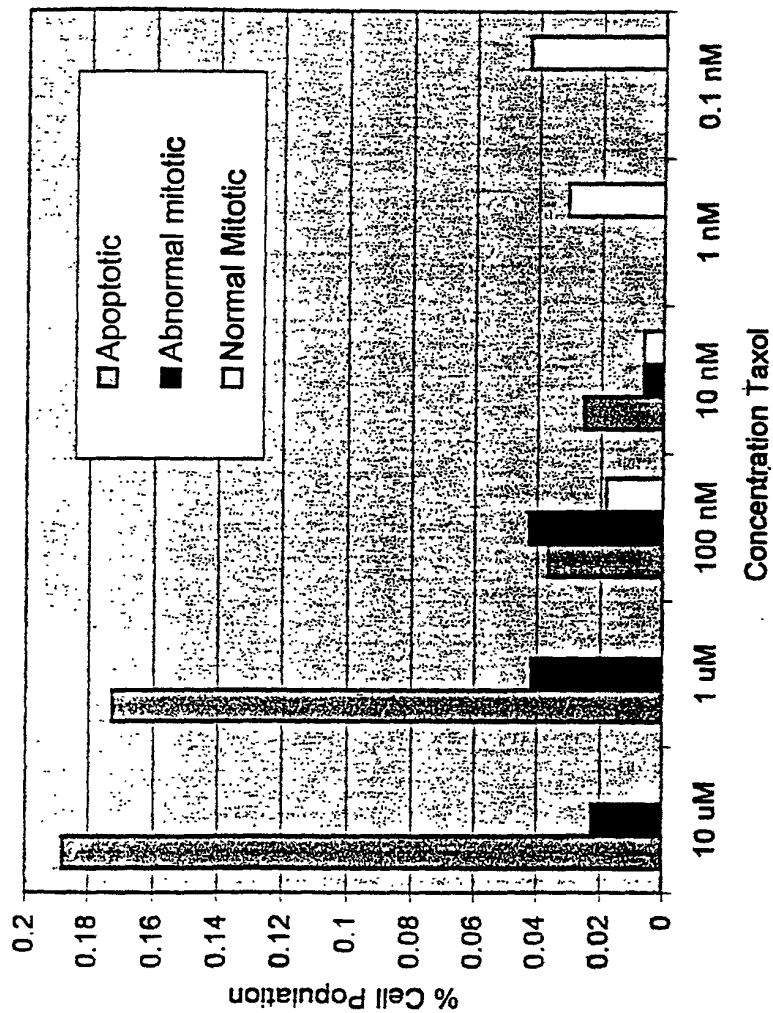


Fig. 5



## Scatter Plot



Normal

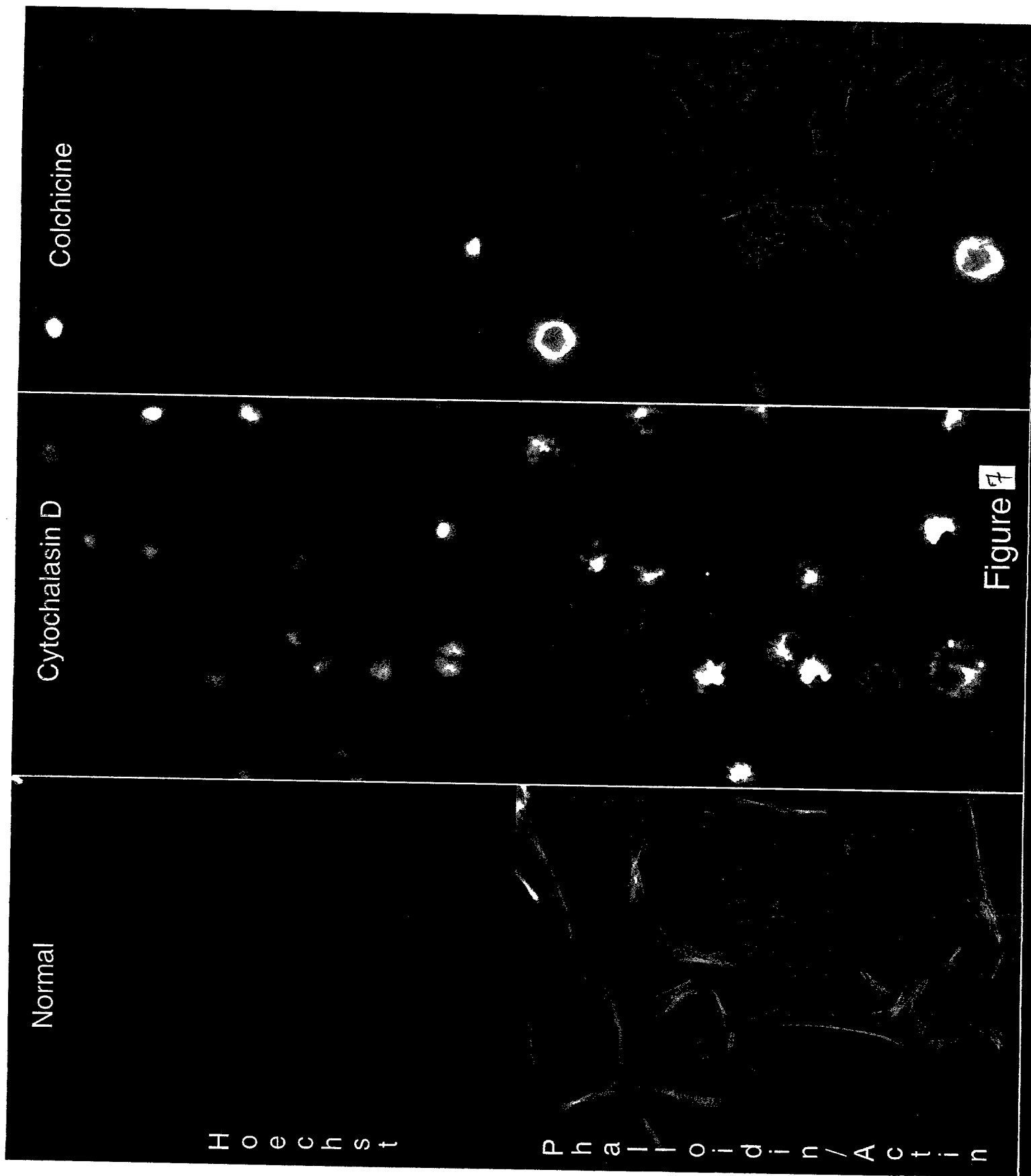
Cytochalasin D

Colchicine

Hoechst

Phalloidin/Actin

Figure 7



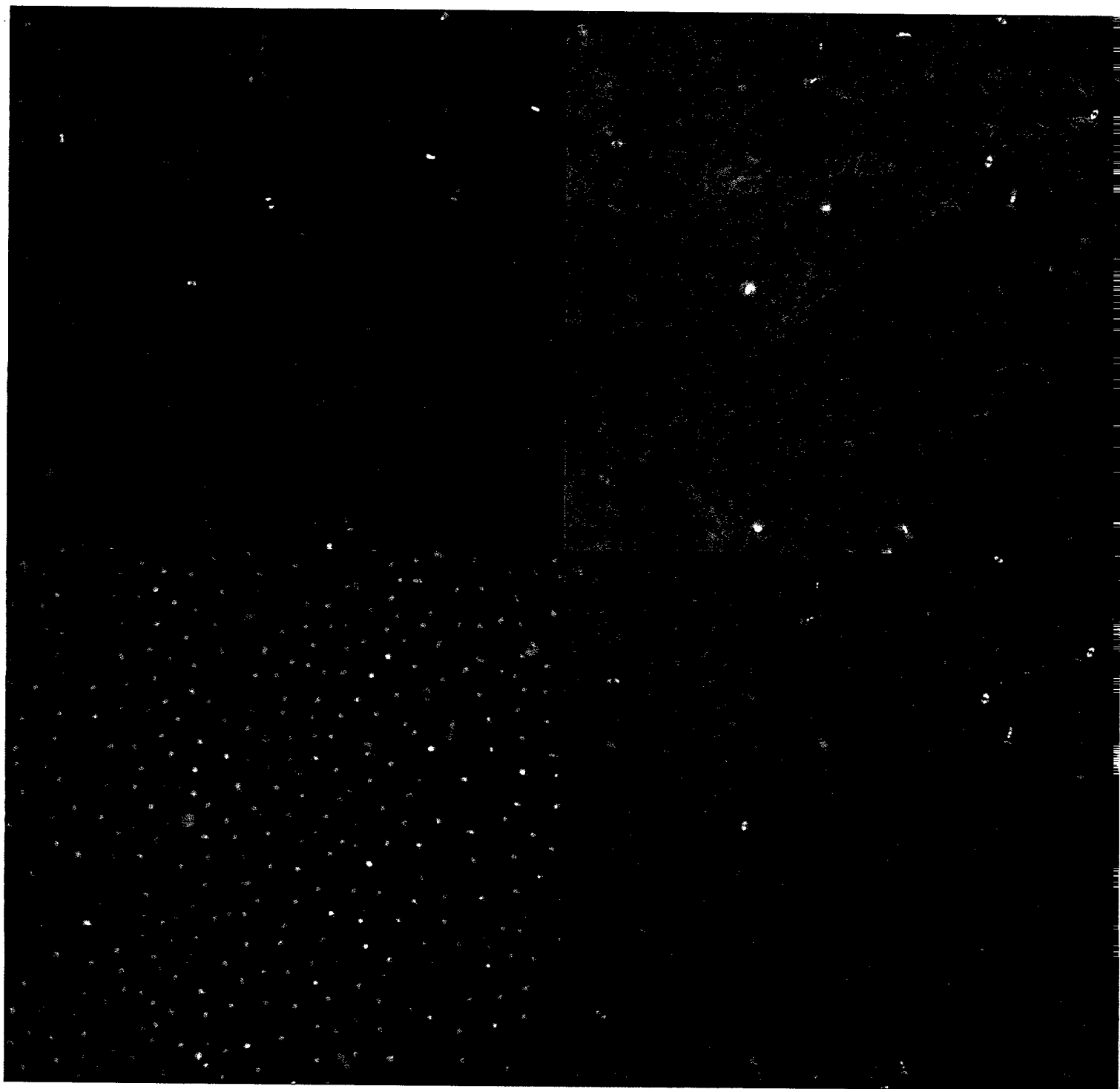


FIG. 8

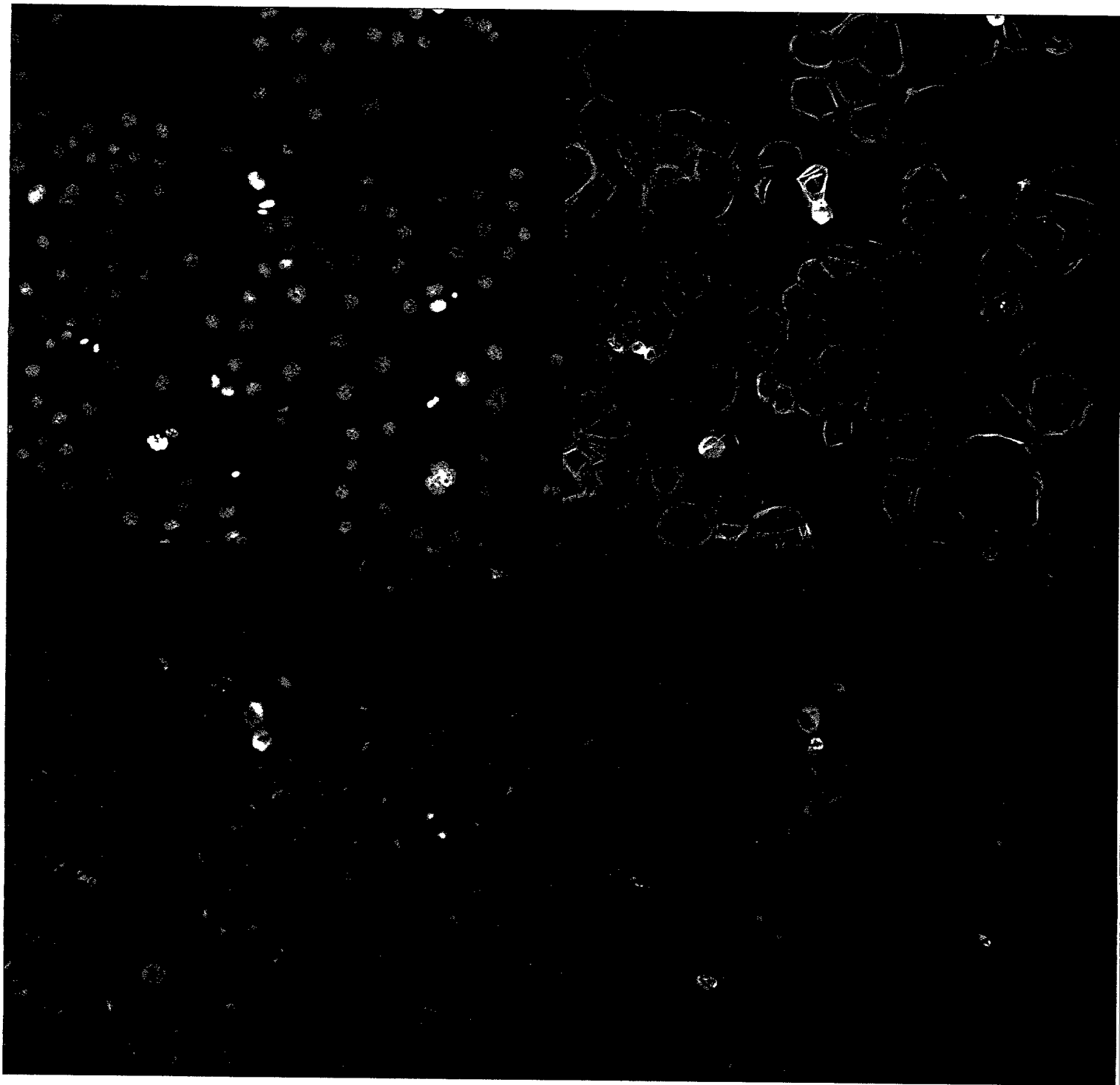


FIG. 9

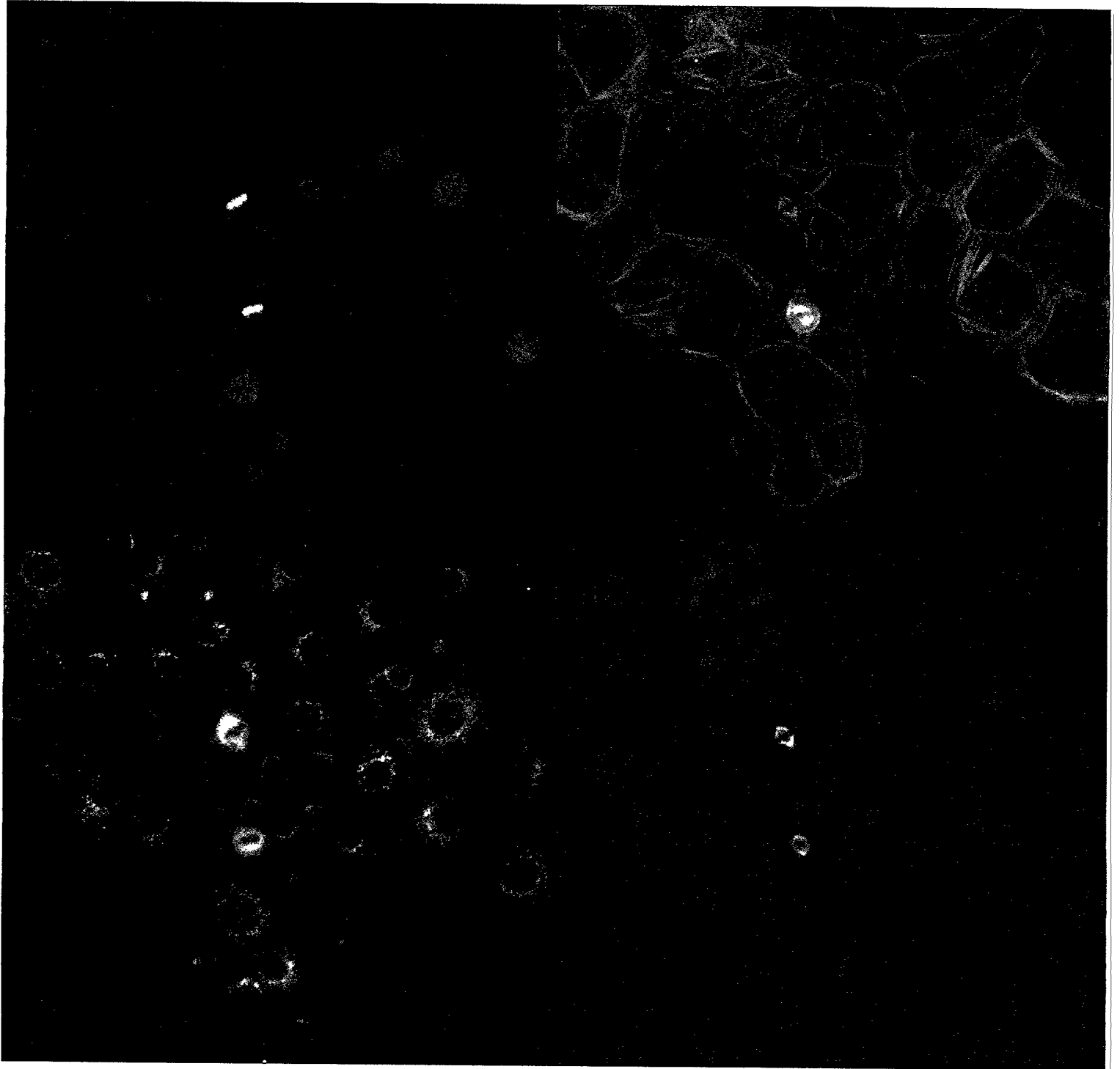


Fig. 10



FIG. 11



Conversion of morphometric parameters into nucleic acid code  
and clustering of the resulting sequences using Neighbor  
Joining method.

Compound:	Measurements																			
	Count	Area	Perimeter	Length	Breadth	Fiber length	Fiber breadth	Shape factor	Ell. form factor	Inner radius	Outer radius	Mean radius	Equiv. radius	Equiv. sphere vol.	Equiv. prolate vol.	Equiv. oblate vol.	Equiv. sphere surface area	Average gray value	Total gray value	Optical density
Control	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t
Taxol	a	t	t	t	t	t	t	t	a	t	t	t	t	t	t	t	t	t	t	t
CD	c	a	a	a	t	a	t	t	c	a	a	a	a	a	a	a	a	t	a	a
Nocodozol	c	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t
Staurosporine	g	g	c	a	a	t	a	a	t	g	a	a	a	t	g	g	g	a	a	t
Vinblastine	c	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	g	t	t
Hydroxyurea	g	t	t	t	t	t	t	g	t	t	t	t	t	t	t	t	t	t	c	t

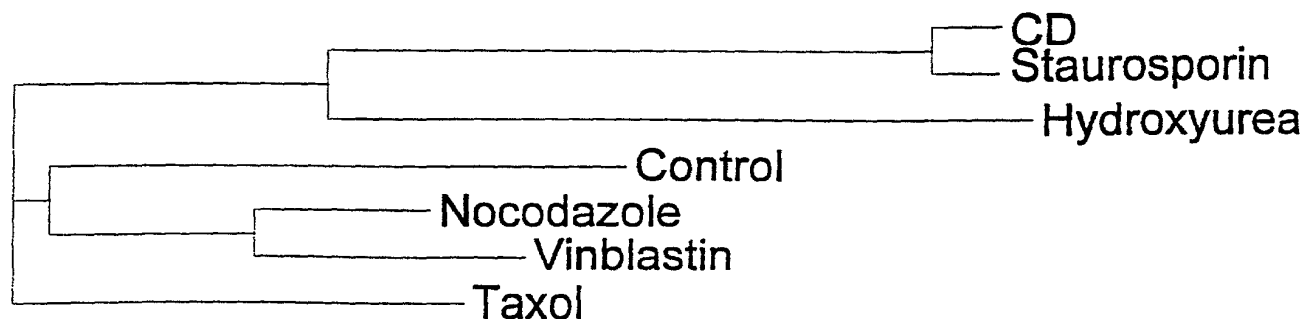
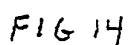


FIG 13



1. The first part of the paper is devoted to a review of the literature on the topic. It starts with a general overview of the field, followed by a more detailed discussion of the specific issues at hand. The author then presents his own findings, which are based on a comprehensive analysis of the available data. Finally, he concludes with some thoughts on the future of the research.

[illegible]

**DECLARATION AND POWER OF ATTORNEY**

As a below named inventor, I declare that:

My residence, post office address and citizenship are as stated below next to my name; I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: **A DATABASE SYSTEM INCLUDING COMPUTER CODE FOR PREDICTIVE CELLULAR BIOINFORMATICS** the specification of which   X   is attached hereto or        was filed on                      as Application No.                      and was amended on                      (if applicable).

I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56. I claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

**Prior Foreign Application(s)**

Country	Application No.	Date of Filing	Priority Claimed Under 35 USC 119

I claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

Application No.	Date of Filing	Status

**POWER OF ATTORNEY:** As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.


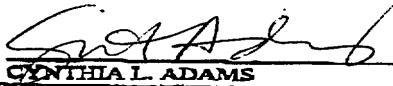


Paul A. Durdik, Reg. No. 37,819  
 Karen Dow, Reg. No. 29,684  
 Richard T. Ogawa, Reg. No. 37,692

Send Correspondence to: <b>Paul A. Durdik</b> <b>TOWNSEND and TOWNSEND and CREW LLP</b> <b>Two Embarcadero Center, 8<sup>th</sup> Floor</b> <b>San Francisco, California 94111-3834</b>	Direct Telephone Calls to: (Name, Reg. No., Telephone No.) Name: <b>Paul A. Durdik</b> Reg. No.: <b>37,819</b> Telephone: <b>650-326-2400</b>
---	---

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Post Office Address:	Post Office Address: 4305 20 <sup>th</sup> Street	City: San Francisco	State/Country: California Postal Code: 94114
Full Name of Inventor 4:	Last Name: CROMPTON	First Name: ANNE	Middle Name or Initial: M.
Residence & Citizenship:	City: San Francisco	State/Foreign Country: California	Country of Citizenship: United States
Post Office Address:	Post Office Address: 2 Bellair Place	City: San Francisco	State/Country: California Postal Code: 94133

further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signature of Inventor 1  EUGENIA A. VAISBERG	Signature of Inventor 2  CYNTHIA L. ADAMS	Signature of Inventor 3  JAMES H. SABRY
Date: 5-13-99	Date: 05/13/99	Date: 5-13-99
Signature of Inventor 4  ANNE M. CROMPTON		
Date: 5-13-99		

PA 191459 v1

***IN THE UNITED STATES PATENT AND TRADEMARK OFFICE***

In re application of: Vaisberg et al.

Attorney Docket No.: CYTOP007C2

Application No.: NEW

Examiner: UNKNOWN

Filed: HEREWITH

Group: UKKNOWN

Title: DATABASE SYSTEM INCLUDING  
COMPUTER FOR PREDICTIVE  
CELLULAR BIOINFORMATICS

**ASSOCIATE POWER OF ATTORNEY  
AND CHANGE OF CORRESPONDENCE ADDRESS IN APPLICATION**

Assistant Commissioner for Patents  
Washington, DC 20231

Sir:

The undersigned attorney of record in the subject patent application hereby grants an Associate Power of Attorney to add the law firm of Beyer Weaver & Thomas, LLP and all practitioners who are associated with the **Customer Number 022434** to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

Please send all correspondence for this application as follows:

**Customer Number 022434**  
BEYER WEAVER & THOMAS, LLP  
P.O. Box 778  
Berkeley, CA 94704-0778



Please direct any calls to **Jeffrey K. Weaver** (510) 843-6200.

Respectfully submitted,  
BEYER WEAVER & THOMAS, LLP

A handwritten signature in black ink, appearing to read "Jeffrey K. Weaver".

Jeffrey K. Weaver  
Reg. No. 31,314

Date: November 21, 2000

## APPENDIX A

# Example of the output of AnalyseDNA.m program (measurements for a single 3 by 3 montage image)

File#	Subimage	object#	X coord	Y coord	Area	Axes Ratio	Eccentricity	Equi-diam	Solidity	Extent	Intensity	Avg. Intensity	Median Intensity	20% Pix.	80% Pix.
1	1	1	12.2897	132.655	145	1.17293	0.52824	13.5675	0.933567	0.739796	4605	31.7566	34	25	37
1	1	2	16.352	416.032	125	1.60594	0.782471	12.6157	0.905797	0.78125	4606	36.848	38	30	45
1	1	3	20.1073	73.8079	177	1.09845	0.413785	15.0121	0.917098	0.691406	4769	28.9435	29	22	31
1	1	4	21.4186	402.744	43	1.36215	0.675904	7.39928	0.914894	0.767857	3690	85.814	87	67	105
1	1	5	27.0938	184	96	1.30887	0.645194	11.0558	0.888889	0.671329	4502	46.8958	49	38	56
1	1	6	30.3252	259.534	206	2.33106	0.903309	16.1953	0.927928	0.715278	6380	30.9709	33	24	37
1	1	7	33.6629	167.573	89	1.34984	0.671696	10.6451	0.927083	0.714561	4225	47.4719	50	39	56
1	1	8	35.0411	16.9726	146	1.34984	0.671696	10.6451	0.927083	0.714561	4225	47.4719	50	39	56
1	1	9	37.766	366.021	47	1.48062	0.839542	7.73578	0.87037	0.652778	6667	141.851	142	113	171
1	1	10	40.1078	170.004	232	1.90491	0.851127	17.187	0.82941	0.70303	9832	42.3793	45	33	51
1	1	11	56.0769	126.534	221	1.95704	0.859595	16.7746	0.94686	0.686335	7040	31.8532	33	25	37
1	1	12	52.7755	44.9932	147	1.33627	0.663301	13.6809	0.907407	0.706731	4765	32.415	34	26	39
1	1	13	52.4444	366.854	171	1.27225	0.897553	14.7555	0.872449	0.706612	9378	54.8421	56	43	68
1	1	14	56.4029	282.272	206	1.92782	0.854944	16.1953	0.937167	0.64375	7137	34.6456	37	28	41
1	1	15	57.0648	227.176	108	1.73885	0.818089	11.7265	0.915254	0.701299	4644	43	45	33	51
1	1	16	68.1714	333.181	315	1.11194	0.437266	20.0267	0.75	0.526756	15151	48.0984	50	36	62
1	1	17	65.1409	402.414	220	1.77678	0.80906	16.7366	0.920502	0.647059	9809	44.5864	46	35	54
1	1	18	71.9649	443.13	185	1.71588	0.812622	12.5143	0.911131	0.723529	4841	33.1027	35	25	39
1	1	19	73.626	184.854	123	1.3357	0.662941	12.7386	0.822581	0.632231	14559	47.5784	50	38	57
1	1	20	77.4577	208.27	306	1.3357	0.662941	12.7386	0.822581	0.632231	14559	47.5784	50	38	57
1	1	21	78.7377	208.27	122	1.64713	0.794114	12.2053	0.866164	0.642857	4686	40.0513	43	32	47
1	1	22	81.4786	53.5812	117	1.64713	0.794114	12.2053	0.866164	0.642857	4686	40.0513	43	32	47
1	1	23	86.7322	281.534	373	2.17388	0.897916	21.7926	0.843991	0.531339	16109	43.1877	46	34	52
1	1	24	88.1755	341.976	85	1.43573	0.717545	10.4031	0.967289	0.704444	4878	34.1119	35	27	41
1	1	25	88.1608	176.231	143	1.30789	0.650391	10.4031	0.870789	0.704444	4878	34.1119	35	27	41
1	1	26	91.4828	375.924	170	1.36553	0.682689	14.7123	0.949121	0.833333	4933	29.0176	30	23	35
1	1	27	97.7804	371.723	280	1.76553	0.862119	19.1482	0.896825	0.668659	4540	40.177	43	33	48
1	1	28	96.5841	230.863	113	1.09435	0.413409	11.5948	0.86825	0.668659	4540	40.177	43	33	48
1	1	29	96.9452	248.602	118	1.27445	0.738227	12.4634	0.945736	0.813333	4663	38.2213	40	31	47
1	1	30	103.053	93.3279	122	1.68415	0.738227	12.4634	0.945736	0.813333	4663	38.2213	40	31	47
1	1	31	103.47	135.507	134	1.32068	0.738111	12.4634	0.945736	0.813333	4663	38.2213	40	31	47
1	1	32	105.356	57.1271	118	1.30339	0.650869	12.2573	0.870592	0.694118	4695	38.7881	42	30	49
1	1	33	121.23	285.08	326	1.70329	0.809514	20.3734	0.870592	0.694118	4695	38.7881	42	30	49
1	1	34	125.532	170.645	141	1.53045	0.757011	13.3988	0.927632	0.734325	4695	38.7881	42	30	49
1	1	35	128.98	60.3355	152	1.75689	0.822208	13.9116	0.921212	0.767677	8810	45.2303	47	36	54
1	1	36	137.083	128.083	266	1.845	0.840375	18.4033	0.796407	0.538462	5910	38.5757	38	25	45
1	1	37	130.502	411.5	164	1.19276	0.54507	14.4503	0.937143	0.788462	7337	44.7318	47	35	53
1	1	38	132.439	352.545	187	1.39705	0.690312	15.4304	0.935	0.799145	5227	25.5519	27	22	34
1	1	39	129.615	16.6154	13	1.15921	0.50579	4.06843	0.928571	0.8125	94	7.23077	8	3	11
1	1	40	136.574	209.099	101	1.12013	0.450546	11.3401	0.87069	0.647436	7293	72.2079	74	58	88
1	1	41	134.455	33.0909	33	1.21149	0.564506	6.48204	0.916667	0.785714	1949	59.0606	60	44	75
1	1	42	140.893	102.008	121	1.47787	0.736306	12.4122	0.916667	0.733333	4808	39.7355	40	32	47
1	1	43	144.884	59.8199	272	1.75519	0.821825	16.6097	0.934708	0.725333	10814	39.7574	41	32	48
1	1	44	147.093	438.435	161	1.3071	0.64397	14.3175	0.925287	0.715556	9000	55.9006	58	44	68
1	1	45	151.46	256.924	224	1.08008	0.377872	16.888	0.937238	0.777778	9654	43.0982	45	33	53
1	1	46	155.688	178.546	141	1.39135	0.695293	13.3988	0.921569	0.801136	7729	54.8156	57	44	65
1	1	47	160.875	342.354	48	1.71551	0.812532	7.81764	0.857143	0.592593	6609	137.688	139	103	168
1	1	48	168.828	11.7677	198	1.42126	0.710595	15.8777	0.933962	0.733333	9931	50.1566	50	39	62
1	1	49	169.613	356.267	217	1.47118	0.820008	16.8125	0.825095	0.5425	7980	36.7742	38	28	43
1	1	50	176.014	356.414	222	1.44188	0.720419	16.8125	0.900763	0.621849	9626	43.3604	46	33	54
1	1	51	175.588	192.983	118	1.13784	0.47708	12.7162	0.900763	0.698225	4671	39.5847	42	32	47
1	1	52	177.191	210.874	127	1.14539	0.487604	12.7162	0.900763	0.698225	4671	39.5847	42	32	47
1	1	53	178.367	410.524	147	1.24127	0.592425	14.7193	0.939227	0.714286	9335	54.9118	58	44	66
1	1	54	182.4	392.476	170	1.24127	0.592425	14.7193	0.939227	0.714286	9335	54.9118	58	44	66
1	1	55	183.368	282.719	196	1.91704	0.834936	15.7973	0.915888	0.742424	5030	25.6633	27	20	31
1	1	56	183.742	53.7416	213	1.36823	0.634328	15.7973	0.934211	0.747368	9655	45.3756	48	38	53
1	1	57	193.158	185.871	264	1.46663	0.634328	15.7973	0.934211	0.747368	9655	45.3756	48	38	53
1	1	58	209.672	185.871	264	1.46663	0.634328	15.7973	0.934211	0.747368	9655	45.3756	48	38	53
1	1	59	209.752	70.0435	230	1.96083	0.906478	17.1127	0.945602	0.804196	9766	42.4609	44	34	53
1	1	60	212.584	368.695	197	1.13679	0.475588	15.0376	0.928245	0.716	4655	21.7466	28	21	34
1	1	61	220.856	30.6237	194	2.67662	0.927588	15.7165	0.928245	0.716	4655	21.7466	28	21	34
1	1	62	224.588	234.29	183	1.34183	0.666785	15.2644	0.943299	0.628054	5076	23.3437	30	23	35
1	1	63	216.292	293.953	171	1.34183	0.666785	15.2644	0.943299	0.628054	5076	23.3437	30	23	35
1	1	64	217.331	330.721	172	1.64627	0.79437	14.7553	0.924731	0.671875	6094	30.3184	32	25	38
1	1	65	217.388	427.1	201	1.29372	0.634448	15.9975	0.926267	0.738971	6094	30.3184	32	25	38
1	1	66	227.926	157.769	121	1.3261	0.656767	12.4122	0.916667	0.733333	4352	35.9669	37	26	42
1	1	67	249.071	488.968	435	3.20117	0.949955	22.3342	0.743359	0.402778	14810	34.046	38	26	42
1	1	68	238.844	245.186	167	1.48408	0.738897	14.5819	0.938202	0.755656	5159	30.8862	32	25	37

69	243.509	88.7857	224	1.87991	0.846782	16.888	0.899598	0.636364	8827	39.4063	42	30
70	248.831	322.144	160	1.79681	0.830819	14.2713	0.91954	0.76555	5025	31.4063	33	25
71	256.234	413.026	77	1.33666	0.778651	9.90149	0.875	0.7	4352	56.5195	59	46
72	259.945	43.816	163	1.38657	0.438651	1.90149	0.91573	0.679167	4720	28.9571	30	23
73	257.061	398.848	66	1.03149	0.243208	9.167	0.91667	0.597619	10500	41.8327	71	56
74	263.602	375.59	251	1.95991	0.660039	17.8769	0.866266	0.597619	5136	41.8327	43	32
75	264.282	233.801	161	1.50584	0.793652	14.3175	0.917355	0.720779	4836	43.7658	45	36
76	264.937	209.802	111	1.31512	0.649472	11.8882	0.909722	0.682232	5633	34.5637	35	28
77	266.137	348.328	131	1.58185	0.774829	12.9149	0.918919	0.596491	7031	34.5637	38	29
78	276.221	171.24	204	2.05613	0.873763	16.1165	0.87234	0.650794	10520	61.3467	63	42
79	277.059	285.098	287	1.78733	0.422329	13.8198	0.920245	0.765306	9202	51.6118	55	43
80	278.337	97.32	150	1.10321	0.422329	13.8198	0.920245	0.765306	9202	51.6118	55	43
81	276.612	331.118	85	1.67318	0.801747	10.4031	0.923913	0.817308	4387	46.3846	49	34
82	285.905	154.719	231	1.56301	0.76855	17.1499	0.931452	0.675439	8580	37.1429	39	31
83	285.326	203.688	221	1.75638	0.822092	16.7746	0.863281	0.701559	10251	45.8146	49	34
84	284.739	335.022	46	1.74017	0.818394	7.65304	0.867925	0.730159	6986	151.87	159	120
85	291.4	319.71	145	1.31364	0.68467	13.5875	0.917722	0.755208	4940	34.069	35	27
86	327.651	442.734	192	2.01531	0.868208	15.6353	0.941176	0.791388	5972	31.1042	32	23
87	291.81	389.276	58	1.25774	0.60651	8.59348	0.920635	0.725	3964	68.3448	70	55
88	299.182	285.182	159	1.39289	0.696112	14.2293	0.929825	0.757143	5103	32.0943	33	26
89	300.14	356.347	180	1.31538	0.649643	13.8198	0.925926	0.78125	5369	35.7933	37	30
90	311.5	320.38	382	1.47517	0.772632	22.054	0.843267	0.598746	16117	42.1911	44	32
91	308.771	132.894	161	1.15063	0.49465	14.3175	0.936047	0.766667	4966	30.8447	33	24
92	312.161	21.8111	180	1.62866	0.789304	15.1388	0.932642	0.728745	4915	27.3056	28	22
93	308.683	204.548	125	1.43436	0.783615	12.666	0.9	0.7	28745	35.2857	40	31
94	317.72	43.06	150	2.18043	0.88863	13.8198	0.882353	0.595238	4950	33.0533	35	25
95	315.779	222.448	145	1.21666	0.569542	13.5875	0.917722	0.74359	5048	34.8138	36	28
96	314.612	386.048	147	1.76365	0.828055	13.8609	0.936306	0.773684	9195	62.551	65	47
97	315.231	75.8831	243	1.37849	0.688296	17.5897	0.945325	0.759375	8192	33.7119	36	27
98	327.295	371.852	207	1.77934	0.525253	16.7345	0.928251	0.761029	4993	24.1208	25	19
99	327.232	313.868	73	1.27861	0.429418	11.7272	0.933562	0.761538	4632	46.7879	50	35
100	328.895	485.333	133	1.81923	0.767193	13.7572	0.9	0.7	28745	28.9412	30	22
101	339.875	495.404	328	2.08293	0.877803	20.3358	0.896175	0.594203	10208	31.122	33	24
102	336.256	341.702	168	1.98758	0.681571	13.7572	0.928177	0.746667	4848	28.6571	29	23
103	335.277	146.088	137	1.47667	0.732647	13.8609	0.903316	0.713542	6932	50.5985	53	41
104	346.608	376.692	130	1.44662	0.724001	12.5865	0.902778	0.666667	4713	36.2538	38	29
105	340.273	422.859	128	1.82797	0.837037	13.7572	0.926018	0.682258	4955	25.1471	30	23
106	341.654	392.101	149	1.21343	0.564431	13.7572	0.926018	0.682258	4955	25.1471	30	23
107	351.93	211.249	201	1.60556	0.747942	13.5975	0.926018	0.682258	4955	25.1471	30	23
108	352.982	107.865	170	1.49726	0.747942	13.5975	0.926018	0.682258	4955	25.1471	30	23
109	360.316	466.868	152	1.86075	0.843317	13.8198	0.926018	0.682258	4955	25.1471	30	23
110	357.882	436.327	110	1.60725	0.57215	11.8345	0.926018	0.682258	4955	25.1471	30	23
111	361.836	338.483	116	1.51165	0.749922	12.135	0.926018	0.682258	4955	25.1471	30	23
112	361.357	65	140	1.27314	0.618912	13.3512	0.926018	0.682258	4955	25.1471	30	23
113	363.058	282.398	103	1.26774	0.618912	13.3512	0.926018	0.682258	4955	25.1471	30	23
114	377.536	52.6893	383	2.24884	0.895101	22.0882	0.891111	0.526099	12083	31.3463	30	23
115	369.901	346.09	111	1.32541	0.656322	12.8828	0.909836	0.776224	4428	39.8919	41	31
116	372.355	389.158	183	1.08717	0.392338	15.2644	0.931043	0.658824	6590	29.1153	30	24
117	375.454	102.31	168	1.77626	0.82647	14.6255	0.931043	0.658824	6590	29.1153	30	24
118	378.105	164.669	172	1.55567	0.766024	14.7986	0.931043	0.658824	6590	29.1153	30	24
119	378.105	487.237	190	1.34387	0.8368045	15.5536	0.931043	0.658824	6590	29.1153	30	24
120	386.803	129.803	142	1.82726	0.751547	16.1953	0.931043	0.658824	6590	29.1153	30	24
121	387.01	222.932	206	1.51589	0.819527	16.1953	0.931043	0.658824	6590	29.1153	30	24
122	384.354	305.719	96	1.74508	0.819527	16.1953	0.931043	0.658824	6590	29.1153	30	24
123	397.856	400.719	313	1.71338	0.812011	15.9631	0.923767	0.792308	10014	48.6117	50	37
124	389.741	281.944	108	1.86676	0.742673	11.7265	0.923767	0.792308	10014	48.6117	50	37
125	393.248	318.762	105	1.49331	0.844817	11.7265	0.923767	0.792308	10014	48.6117	50	37
126	395.708	20.375	120	1.06484	0.43362	12.3608	0.916031	0.769231	4538	37.8167	39	32
127	395.708	20.375	120	1.83729	0.838903	15.7165	0.932692	0.769841	9702	50.0103	52	39
128	402.562	362.046	130	2.18482	0.89105	12.8655	0.902778	0.601852	4566	35.1231	37	28
129	402.562	35.0744	121	1.34169	0.666695	12.4122	0.909774	0.720238	4622	38.1983	41	31
130	407.174	349.368	109	1.61058	0.810958	11.7896	0.908333	0.698718	4423	40.6697	42	31
131	407.174	349.368	109	2.20337	0.879632	13.4462	0.896734	0.71	4284	30.169	32	23
132	408.541	422.307	142	1.93507	0.717235	14.8843	0.910395	0.74359	4845	27.8448	29	21
133	415.673	320.856	118	1.36843	0.682628	13.8609	0.93038	0.765625	4976	33.8503	36	28
134	419.881	251.834	147	1.70261	0.803346	12.5513	0.887218	0.695128	4506	38.9432	41	31
135	428.757	224.643	172	1.24283	0.593793	14.7956	0.92973	0.764444	5120	29.7674	32	24
136	428.757	38.3016	126	1.54199	0.593057	12.666	0.926471	0.75	5385	38.3889	36	30
137	434.977	106.932	222	1.74232	0.818891	16.8125	0.925	0.720779	7043	31.7252	33	25
138	432.809	424.282	131	1.70121	0.808993	12.9149	0.922535	0.770588	4251	32.4504	33	24
139	431.155	477.519	129	1.14151	0.48225	12.8159	0.914894	0.767857	4397	34.0078	35	27
140	438.675	12.7222	126	1.77999	0.624207	12.666	0.933333	0.75	4445	35.2778	38	26
141	441.29	461.766	124	1.33453	0.662198	12.5651	0.918319	0.688889	4658	37.5645	40	30
142	445.287	152.375	136	1.38301	0.690787	13.159	0.912752	0.708333	5017	36.8897	39	28
143	452.32	495.598	306	1.66314	0.789045	15.7386	0.918919	0.796875	17726	57.5281	61	47
144	451.122	370.49	288	1.77678	0.826582	19.1492	0.825215	0.659039	11388	39.5417	42	30

1	1	145	462.718	316.942	291	2.5992	0.923028	19.2487	0.716749	0.534926	9565	32.8694	32	23	43
1	1	146	455.84	345.437	119	1.51711	0.752012	12.3092	0.915385	0.793333	4473	37.5882	39	28	46
1	1	147	458.357	398.325	154	1.73345	0.816825	14.0028	0.922156	0.712963	8038	52.1940	55	42	62
1	1	148	459.428	30.199	201	1.48473	0.739168	15.9975	0.934884	0.755639	4615	22.9602	24	18	27
1	1	149	462.472	163.039	127	1.2763	0.621371	12.7162	0.947761	0.824675	4849	38.1811	40	30	46
1	1	150	465.094	234.432	405	1.31202	0.653423	22.7082	0.89404	0.771429	9811	24.2247	25	19	29
1	1	151	459	185	23	1.22522	0.577796	5.41152	0.851852	0.657143	2687	116.826	118	86	135
1	1	152	469.289	73.6404	228	1.63152	0.766399	17.0382	0.919355	0.690909	8169	35.8289	37	28	44
1	1	153	468.291	365.573	117	1.37288	0.685157	12.2053	0.919355	0.835714	4553	38.9145	40	32	45
1	1	154	469.261	188.174	23	1.17386	0.623719	5.41152	0.92	0.766667	2572	111.826	115	97	134
1	1	155	477.09	285.407	199	1.33807	0.664436	15.9177	0.947619	0.737037	7638	38.3819	40	31	46
1	1	156	480.109	124.394	138	1.47131	0.733523	13.2555	0.936174	0.704082	4514	32.7101	34	27	39
1	1	157	485.215	212.969	163	1.9846	0.865802	14.4062	0.91573	0.679167	6791	41.6626	43	33	51
1	1	158	493.435	450.984	129	1.45523	0.730898	12.8159	0.921429	0.716667	4590	35.5814	37	28	44
1	1	159	498.138	257.492	197	1.18457	0.536047	15.8376	0.933649	0.765311	6331	32.1371	34	25	38
1	1	160	498.107	423.713	122	1.38074	0.694957	12.4634	0.910448	0.733934	4778	39.1639	40	31	48
1	1	161	504.754	480.579	107	1.30683	0.638559	11.672	0.938596	0.743056	4301	40.1963	42	32	47
1	2	1	16.0133	489.207	150	1.82513	0.83654	13.8188	0.9375	0.789474	5013	33.42	35	26	40
1	2	1	12.4511	92.619	126	1.24511	0.595788	12.666	0.939708	0.75	15	16.7817	39	31	44
1	2	3	12.7436	294.949	78	1.26896	0.585955	9.9657	0.936977	0.787979	4177	43.5513	54	42	65
1	2	4	21.4605	27.5132	152	2.05915	0.874151	13.9116	0.933663	0.59375	7398	55.2132	48	33	52
1	2	5	24.5889	412.717	180	1.41069	0.705337	15.1388	0.923077	0.711486	7613	42.2494	48	33	52
1	2	6	30.8013	150.013	151	1.5312	0.757285	13.8658	0.937088	0.807467	4834	32.0132	34	23	35
1	2	7	35.9216	117.641	153	1.10365	0.42309	13.9573	0.937088	0.728571	8847	37.8235	60	46	70
1	2	8	32.4386	483.965	57	1.17959	0.530388	6.51908	0.904762	0.791667	7839	137.526	182	104	175
1	2	9	41.1142	48.0551	234	2.15977	0.886332	17.9834	0.927007	0.753964	8532	33.5906	36	27	39
1	2	10	46.0543	205.164	159	1.43069	0.715156	14.2283	0.929825	0.779412	5043	31.717	32	25	38
1	2	11	47.0543	98.2403	129	1.6944	0.807273	12.8159	0.921429	0.661538	4898	37.6589	39	28	46
1	2	12	48.3386	164.971	138	1.40133	0.700548	13.2555	0.926174	0.784091	4896	35.4783	38	28	42
1	2	13	54.1071	128.629	140	1.31888	0.652002	13.3512	0.921053	0.777778	7556	53.9714	56	42	63
1	2	14	61.2347	252.877	375	1.46523	0.730898	11.851	0.868056	0.652174	18248	48.6613	52	38	60
1	2	15	58.7059	420.598	102	1.16735	0.515912	11.3361	0.902655	0.713281	8303	81.402	84	69	96
1	2	16	62.8217	161.434	286	1.44931	0.723823	19.0826	0.925566	0.654462	10326	36.1049	38	28	45
1	2	17	68.6289	183.686	194	1.89744	0.849849	15.7165	0.92823	0.769841	7275	37.5	39	29	47
1	2	18	72.3973	25.8873	204	1.65928	0.797591	16.1165	0.934737	0.647619	4906	24.049	28	18	29
1	2	19	83.1654	62.6808	260	1.92679	0.854775	18.1946	0.9319	0.656566	10031	38.5808	40	31	47
1	2	20	96.7188	481.695	256	2.0471	0.872567	18.0541	0.885913	0.592593	9587	37.4492	37	29	47
1	2	21	94.0154	108.485	130	1.50401	0.746594	12.8655	0.915493	0.738636	4616	35.5077	36	26	44
1	2	22	101.034	140.034	207	1.65907	0.797932	16.2345	0.924107	0.758242	9618	46.4638	48	37	56
1	2	23	106.469	179.984	254	2.25068	0.895873	17.9834	0.92029	0.552174	9484	37.3386	40	29	46
1	2	24	118.615	45.286	455	2.24916	0.895724	24.0692	0.803887	0.530303	19707	43.3121	45	31	56
1	2	25	109.325	462.783	157	1.33362	0.663618	14.1386	0.934524	0.769608	7940	50.5732	53	38	62
1	2	26	112.224	30.2115	156	1.68158	0.803963	14.0935	0.912281	0.65	4684	30.0256	31	24	37
1	2	27	114.738	94.3108	130	2.20139	0.89087	12.8655	0.866667	0.546218	4593	35.3308	36	27	45
1	2	28	113.664	117.473	131	1.89702	0.849777	12.9149	0.879195	0.582222	4551	34.7405	35	27	42
1	2	29	119.492	260.982	195	2.26309	0.898974	15.757	0.928571	0.633117	9042	46.3692	50	36	55
1	2	30	120.342	164.685	203	1.63181	0.780225	16.0769	0.911193	0.712281	9555	47.069	48	37	58
1	2	31	125.017	493.152	302	2.03965	0.871585	19.6091	0.92638	0.770408	16405	54.3212	57	43	66
1	2	32	128.12	375.944	125	1.54817	0.7634	12.6157	0.919118	0.668813	4694	37.552	39	29	46
1	2	33	134.357	246.786	182	1.35043	0.643043	15.2227	0.943005	0.784706	9424	51.7802	54	42	62
1	2	34	134.824	435.275	182	1.39127	0.69525	15.2227	0.933333	0.713725	8568	52.5714	55	42	63
1	2	35	137.463	477.361	205	1.6789	0.802993	16.1559	0.911111	0.719638	10137	48.4488	50	36	61
1	2	36	140.229	112.255	275	2.43852	0.92047	18.7121	0.813609	0.456333	5908	36.0831	38	27	45
1	2	37	144.759	62.396	303	2.77691	0.932909	19.6416	0.733656	0.50101	9815	32.3927	35	25	39
1	2	38	142.944	349.208	125	1.15101	0.495153	12.6157	0.925926	0.801282	4627	37.016	38	30	44
1	2	39	155.234	38.7854	410	2.62596	0.924652	22.8479	0.742754	0.415822	14441	35.222	36	25	47
1	2	40	145.827	141.547	150	1.38574	0.692274	13.8198	0.914534	0.721154	5019	33.46	35	26	40
1	2	41	171.118	418.674	144	2.13773	0.883842	13.5406	0.9	0.571429	4475	31.0764	32	24	38
1	2	42	169.885	483.963	218	2.03707	0.871215	16.6603	0.904564	0.619318	4735	21.7202	23	17	26
1	2	43	173.468	380.368	171	1.76541	0.824104	14.7555	0.909574	0.7125	4792	28.0234	30	21	34
1	2	44	173.139	451.197	122	1.71693	0.812877	12.4634	0.897059	0.717647	4270	35	34	27	44
1	2	45	177.184	127.971	343	2.17611	0.88816	20.8979	0.859649	0.714833	17821	51.9563	55	42	62
1	2	46	178.975	44.5574	122	1.47137	0.733547	12.4634	0.917293	0.739394	4501	36.8934	39	30	44
1	2	47	184.558	101.091	165	1.53097	0.757203	14.4943	0.921788	0.746606	5051	30.6121	32	25	36
1	2	48	187.282	274.494	174	2.03959	0.871557	14.8843	0.910955	0.690476	4760	27.3563	28	21	33
1	2	49	191.89	364.491	153	1.86387	0.84389	14.4062	0.926135	0.679167	4539	37.8466	29	22	33
1	2	50	201.221	456.572	145	1.33621	0.632651	13.5975	0.941558	0.690476	4681	32.2828	33	24	40
1	2	51	201.162	356.396	111	1.70656	0.810281	11.8882	0.880352	0.69375	4314	37.6687	30	21	33
1	2	52	204.031	41.5031	163	2.03967	0.868819	14.4062	0.910515	0.740909	4510	32.1724	34	27	44
1	2	53	206.779	234.317	145	1.69903	0.808446	13.5675	0.86625	0.710784	4655	39.9121	41	31	48
1	2	54	209.482	328.447	114	1.21621	0.569165	12.0478	0.924511	0.613608	4840	28.3671	31	23	35
1	2	55	218.386	102.956	158	1.97132	0.861784	14.1835	0.934511	0.635628	489	28.5824	30	23	39
1	2	56	218.981	432.981	157	2.05395	0.873476	14.1366	0.902239	0.635628	489	32.0953	33	25	39
1	2	57	221.277	471.106	141	1.42444	0.712149	13.3980	0.933775	0.801136	426	33.7612	35	26	42
1	2	58	221.709	401.149	134	1.06894	0.353312	13.0619	0.911565	0.736264	4324	46.2478	48	36	55
1	2	59	222.761	129.858	113	1.23854	0.590005	11.9948	0.904	0.733766	5226				



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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
60	223.098	346.61	123	1.19435	0.546784	12.5142	0.94632	0.732143	4533	36.8537	38	29	44																
61	231.301	213.059	171	1.87139	0.845282	14.7553	0.924324	0.7125	5697	31.2573	35	26	40																
62	230.337	300.573	178	1.64435	0.793828	14.7553	0.927083	0.698039	4786	26.8876	28	21	34																
63	233.936	63.4295	288	1.96264	0.860461	43.4788	0.849003	0.620833	9681	32.4866	34	26	59																
64	243.615	495.715	480	1.27632	0.621387	24.7215	0.933852	0.698935	23344	48.6353	52	40	47																
65	239.465	21.8994	159	1.59375	0.778656	34.2283	0.908571	0.686067	6050	38.0503	39	25	56																
66	238.765	118.85	107	1.3017	0.640175	11.672	0.90678	0.748323	5042	47.1215	48	39	56																
67	248.411	107.352	219	1.76031	0.822971	16.6985	0.8327	0.608333	10494	47.9178	30	36	59																
68	248.387	240.387	163	1.11782	0.528789	14.4062	0.936782	0.77619	4802	29.4601	31	22	35																
69	251.401	459.551	147	1.36285	0.679415	13.6809	0.924528	0.765625	5259	35.7755	37	28	44																
70	252.144	48.2734	139	1.28227	0.625943	13.3034	0.914474	0.772222	6892	49.5827	51	39	60																
71	265.238	469.394	160	1.46715	0.731733	14.273	0.924855	0.784314	5318	33.2375	35	28	38																
72	270.909	422.169	516	3.69314	0.962643	25.6318	0.786585	0.565789	24246	46.9884	48	34	60																
73	273.05	102.567	201	1.84028	0.915121	15.9975	0.922018	0.644231	5194	25.8408	27	19	37																
74	275.753	332.912	170	1.84216	0.933835	14.7123	0.918919	0.708233	4889	28.7588	30	21	37																
75	282.79	24.9535	157	1.45739	0.727454	14.1386	0.94012	0.769608	8907	56.7325	59	46	68																
76	304.73	201.073	178	1.19701	0.549623	15.0545	0.93228	0.747899	9829	55.2191	56	41	68																
77	305.481	484.962	185	2.0845	0.877415	15.3476	0.91133	0.629452	4596	24.8432	26	19	30																
78	307.247	40.9177	158	1.24996	0.599963	14.1835	0.934911	0.759615	5031	31.8418	34	26	37																
79	308.276	329.299	127	1.83279	0.838036	12.7162	0.900709	0.661458	4575	36.0236	37	27	44																
80	310.67	141.898	176	1.86898	0.84482	14.9696	0.91217	0.651852	4921	27.9602	29	21	34																
81	315.681	247.266	229	1.52513	0.755038	17.0755	0.923387	0.726984	10311	45.0262	47	34	55																
82	314.616	302.312	170	1.42819	0.713958	14.7123	0.923913	0.714286	4865	28.6176	29	23	35																
83	320.424	216.509	228	3.16105	0.687826	17.0382	0.938272	0.76	10187	44.6798	46	37	53																
84	320.424	423.867	228	3.16105	0.687826	17.0382	0.938272	0.76	10187	44.6798	46	37	53																
85	319.458	376.39	216	2.73428	0.920722	16.5837	0.892562	0.54	4741	21.9491	22	17	27																
86	323.423	53.4284	182	1.63137	0.715461	15.2237	0.923958	0.722222	9774	53.7033	57	43	63																
87	340.016	384.483	286	2.30215	0.904059	17.6579	0.81457	0.630768	9905	40.2642	43	32	49																
88	344.4	270.337	285	1.48443	0.716877	15.0432	0.931373	0.714286	10324	36.2246	37	29	44																
89	340.84	65.4787	94	1.19007	0.542146	10.54	0.930816	0.712121	4464	47.6894	51	37	57																
90	341.06	478.91	134	2.10084	0.867577	13.0619	0.937063	0.753826	4299	32.0821	33	25	39																
91	345.369	334.047	189	1.10502	0.625497	13.7736	0.937063	0.753826	4299	32.0821	33	25	39																
92	337.492	371.092	249	1.84813	0.840967	17.8055	0.932584	0.691667	6388	46.3775	27	21	33																
93	334.205	391.672	122	1.48764	0.711944	12.4634	0.917293	0.67033	5113	38.2339	40	30	46																
94	353.903	77.2419	124	1.57831	0.733669	12.5651	0.892086	0.68889	4741	36.2339	40	30	46																
95	355.409	136.509	110	1.41914	0.720445	11.8345	0.916667	0.785714	4501	40.2339	42	32	46																
96	361.412	208.768	194	1.20688	0.559863	15.7165	0.932592	0.760784	7985	41.1598	43	32	50																
97	363.681	417.549	113	2.73659	0.930843	11.9948	0.849624	0.523114	2950	26.1062	26	16	36																
98	370.626	159.489	131	1.56713	0.769945	12.9149	0.91875	0.81875	4759	36.3282	37	29	43																
99	373.978	497.422	225	1.84477	0.840332	16.9257	0.918367	0.696443	9414	41.84	43	33	52																
100	375.192	63.568	125	1.35274	0.673444	12.6157	0.932936	0.739645	4708	37.664	39	30	46																
101	372	428.5	6	1.5	0.745356	2.76395	1	0.932936	54	9	8	11	11																
102	375.31	461.469	113	2.32052	0.902381	11.9948	0.862595	0.627778	2648	23.4336	24	17	30																
103	372	1	1	1	0	1.12838	1	0.917722	9	9	9	9	9																
104	380.145	395.421	145	1.61066	0.783919	13.5875	0.917722	0.697115	4480	30.8966	32	24	38																
105	384.421	107.916	202	1.72134	0.81394	16.0373	0.874459	0.590643	8500	42.0792	42	29	54																
106	385.149	314.015	195	1.58139	0.776623	15.757	0.924171	0.684211	9749	49.9949	52	38	63																
107	394.915	294.683	82	1.56076	0.767781	10.2179	0.87234	0.630769	7836	95.561	100	77	114																
108	407.296	388.112	179	1.93382	0.855918	15.0967	0.92268	0.639286	4942	27.6089	28	20	36																
109	405.333	167.802	162	1.96376	0.860631	14.3619	0.9	0.609023	4778	29.4938	31	22	36																
110	405.662	54.9615	130	1.23602	0.587746	12.8655	0.915493	0.714286	4523	34.7823	36	27	42																
111	409	479.357	129	1.86558	0.844201	12.8655	0.915493	0.714286	4523	34.7823	36	27	42																
112	418.228	100.644	180	1.28967	0.631482	15.1388	0.891089	0.613636	9758	43.4667	47	33	53																
113	426.611	225.589	270	1.81845	0.835218	18.5412	0.891089	0.613636	9758	43.4667	47	33	53																
114	423.62	101.364	129	1.41093	0.705455	12.8159	0.902098	0.716667	4596	35.6279	37	27	43																
115	425.759	183.281	139	1.85684	0.842594	13.3034	0.908497	0.620536	4569	32.8705	35	25	40																
116	429.95	439.218	206	1.51878	0.752647	16.1953	0.916084	0.774436	7146	49.8473	53	37	60																
117	425.908	491.557	131	1.4753	0.723042	12.9149	0.91																						

1	2	136	485.88	366.669	299	2.80072	0.934085	19.5115	0.89521	0.68994	14065	47.0401	50	38	57
1	1	137	488.732	106.247	190	1.75179	0.821058	15.5536	0.855956	0.666667	8786	46.2421	50	35	57
1	2	138	492.338	317.287	195	1.3628	0.673985	15.757	0.933014	0.77381	5608	27.7333	29	34	57
1	1	1	10.098	359.078	102	1.21521	0.56818	11.3961	0.918919	0.713287	5098	54	58	39	68
1	3	2	14.7415	119.565	147	1.89992	0.800152	13.6809	0.88024	0.576471	5099	34.6871	37	25	44
1	1	3	16.517	374.364	176	1.49674	0.744054	14.9696	0.926316	0.647059	9866	56.0568	60	45	68
1	3	4	13	374.453	82	1.20928	0.562236	10.2179	0.88172	0.683333	4420	53.9024	56	46	64
1	1	3	22.1517	333.427	211	1.49712	0.744206	16.3907	0.905579	0.703333	9538	45.2038	47	35	55
1	3	5	22.7297	353.041	74	1.16551	0.513657	9.70668	0.809592	0.747475	4079	55.1216	56	44	66
1	1	3	23.7391	366.87	69	1.44756	0.723029	9.3702	0.873418	0.69697	3983	57.7246	59	48	70
1	3	8	34.5623	505.832	155	2.56212	0.920687	19.4461	0.839983	0.53902	11784	39.6768	41	31	48
1	1	3	31.9742	455.730	233	1.53061	0.789875	14.0482	0.933735	0.691964	4887	31.529	33	24	39
1	3	10	44.7725	455.730	233	1.8978	0.864246	17.224	0.859403	0.647222	9369	40.2103	42	31	50
1	1	3	51.9162	455.730	233	1.67447	0.802093	15.5945	0.896714	0.635667	9954	52.1152	54	42	62
1	3	12	62.4298	265.297	219	1.22558	0.581665	16.6955	0.862205	0.608333	8759	44.5616	46	36	54
1	1	3	65.7599	171.544	213	2.19727	0.890435	16.4682	0.946667	0.806818	7486	35.1455	36	27	43
1	3	14	63.4132	488.702	121	1.59052	0.806279	12.4122	0.923664	0.75825	4267	35.565	37	28	43
1	1	3	73.3548	488.702	121	1.30361	0.64153	14.0482	0.922619	0.745192	3280	27.571	22	50	71
1	3	15	329.552	183	1.97089	0.861719	15.2644	0.915	0.915	0.72619	4967	27.1461	29	21	33
1	1	3	80.0286	381.648	210	1.64688	0.794543	16.3518	0.922204	0.714286	7257	34.551	37	27	41
1	3	16	79.6596	291.823	141	1.25467	0.603949	13.9988	0.933775	0.783333	4630	34.2553	36	27	40
1	1	3	80.1048	301.169	124	1.39545	0.637472	12.5651	0.923375	0.783333	4630	34.2553	36	27	40
1	3	18	86.0368	103.451	164	1.55708	0.766515	14.4503	0.916201	0.689076	5296	32.2927	34	25	39
1	1	3	90.3161	139.787	174	1.67033	0.800986	14.8843	0.920635	0.654135	4690	26.554	29	21	32
1	3	21	85.1818	504.591	22	1.58172	0.774787	5.2257	0.916667	0.733333	1517	68.9545	68	64	76
1	1	3	88.1818	72.4186	43	1.89078	0.848695	7.39928	0.914894	0.671875	6443	149.897	135	105	186
1	3	23	95.9043	437.878	188	1.46558	0.731051	15.4716	0.930693	0.706767	4330	23.0319	23	18	28
1	1	3	103.775	259.664	271	2.25576	0.896369	18.5755	0.73842	0.531373	10362	38.2362	40	30	47
1	3	26	101.716	351.385	109	1.36499	0.680653	11.7806	0.923729	0.778571	4566	41.8899	44	34	53
1	1	3	100.971	381.4	105	1.68452	0.804731	11.5624	0.913043	0.673077	4538	43.219	45	34	53
1	3	28	102.731	26.3077	182	1.46207	0.729519	15.2227	0.938144	0.722222	5335	29.2132	31	24	39
1	1	3	108.742	241.381	252	1.52887	0.756426	17.9125	0.928571	0.722222	4831	35.1787	38	28	46
1	3	30	107.862	297.946	130	1.2305	0.58271	12.8655	0.928571	0.722222	4831	35.1787	38	28	46
1	1	3	117.68	139.313	128	1.2113	0.564315	12.7662	0.941116	0.761905	4503	35.1787	38	28	46
1	3	32	117.676	420.503	145	1.53776	0.759681	13.5875	0.91195	0.710784	3963	27.331	28	21	34
1	1	3	119.99	374.808	104	1.58258	0.775068	11.5073	0.912281	0.675325	4622	44.4423	45	34	55
1	3	34	124.631	466.313	160	2.13828	0.883905	14.073	0.855615	0.666667	3953	24.7063	25	19	31
1	1	3	125.541	492.842	133	1.14799	0.491128	13.0131	0.93007	0.730769	3821	28.7293	30	23	34
1	3	36	129.158	286.64	114	1.81038	0.833599	12.0478	0.919355	0.791667	4370	40.0877	42	31	43
1	1	3	135.662	301.387	80	1.7702	0.825154	10.0925	0.898876	0.714286	4315	53.9375	55	42	67
1	3	38	144.778	93.4454	216	1.26728	0.614772	16.5378	0.935065	0.75	8028	37.1667	39	30	44
1	1	3	144.088	361.596	114	1.78966	0.829327	12.0478	0.912	0.626374	4590	40.2632	42	32	49
1	3	40	147.37	232.151	119	1.2221	0.574839	12.3092	0.922481	0.772727	8226	69.1261	72	52	83
1	1	3	150.157	435.098	102	1.36069	0.678155	11.3961	0.910714	0.713287	3854	37.7843	40	31	45
1	3	42	154.435	412.167	108	1.47096	0.733373	11.7265	0.915254	0.701299	4156	38.4815	40	30	46
1	1	3	158.445	295.772	254	2.29566	0.90022	17.9834	0.84106	0.529167	9778	38.4961	40	31	48
1	3	44	159.99	30.2537	201	1.64983	0.793681	15.9975	0.934884	0.705263	6592	34.7861	36	27	42
1	1	3	159.799	272.021	144	1.23912	0.590519	13.5406	0.923077	0.738462	9195	63.8542	69	52	76
1	3	46	166.637	380.408	267	1.55549	0.796946	18.4379	0.946809	0.794643	10321	39.4045	41	29	49
1	1	3	170.118	433.126	119	1.42923	0.714457	12.3092	0.915385	0.708333	4156	34.9244	36	26	43
1	3	48	174.639	471.702	191	1.56563	0.879866	15.5945	0.945545	0.757937	8388	43.9162	45	36	52
1	1	3	175.884	132.608	134	1.55335	0.675001	14.0028	0.927711	0.733333	6793	44.1104	46	34	54
1	3	50	182.282	74.0719	133	1.43514	0.703954	13.9573	0.921687	0.75	4953	32.3725	34	26	38
1	1	3	188.486	428.574	144	2.14718	0.854528	13.5406	0.89441	0.571429	4506	31.2917	33	23	39
1	3	52	196.816	173.406	293	1.59008	0.771488	13.147	0.904321	0.63857	21249	72.5222	74	57	89
1	1	3	194.99	340.259	286	1.8224	0.827754	19.0846	0.923566	0.733333	10276	38.5301	37	29	43
1	3	54	202.502	293.631	293	2.40846	0.909729	19.2147	0.84438	0.631466	10024	34.2216	36	26	42
1	1	3	206.054	40.8423	222	1.32324	0.654892	16.8125	0.936709	0.778947	9681	43.6081	46	34	53
1	3	56	218.937	319.989	269	1.78272	0.827856	18.5068	0.896667	0.68798	10198	37.9108	40	30	45
1	1	3	217.344	409.796	250	1.92424	0.854357	17.8412	0.816993	0.548246	9609	38.436	39	29	48
1	3	58	215.452	102.911	157	1.45643	0.727025	14.1386	0.928994	0.769608	6078	39.7134	40	31	46
1	1	3	221.224	468.737	304	1.81246	0.834019	15.674	0.87106	0.603175	20052	65.9605	70	51	81
1	3	60	224.342	365.0872	149	1.76511	0.824533	13.7736	0.93125	0.776042	4599	30.8658	33	25	36
1	1	3	228.918	451.459	159	1.38781	0.693392	14.2283	0.924419	0.719457	4908	30.8679	32	25	37
1	3	62	236.586	365.865	237	1.34179	0.667662	17.3731	0.846429	0.658333	5845	24.6624	25	18	31
1	1	3	235.433	13.93773	97	1.30302	0.758418	11.1132	0.928205	0.769841	4282	44.1443	47	32	44
1	3	64	238.177	54.9398	181	1.66383	0.799233	15.1526	0.941748	0.769841	4282	44.1443	47	32	44
1	1	3	242.074	491.788	189	1.72034	0.81214	12.7652	0.928205	0.760504	4749	26.2376	28	21	32
1	3	66	239.109	254.516	128	1.67034	0.81214	12.7652	0.935644	0.725923	4786	25.3228	26	21	30
1	1	3	245.439	301.048	285	1.7139	0.818906	14.0482	0.914286	0.761905	5045	39.2578	41	31	45
1	3	68	244.548	442.484	155	1.8317	0.89506	14.0482	0.940594	0.652174	8867	31.1123	32	25	37
1	1	3	252.391	69.7091	110	1.93453	0.914159	11.6345	0.92437	0.763889	4359	39.6273	41	33	48
1	3	70	260.993	36.7084	139	1.93453	0.856033	13.3034	0.902597	0.759167	4647	33.4317	34	26	41
1	1	3	260.867	75	1.38481	0.691768	9.77205	0.882353	0.654444	8191	109.213	109	86	132	167
1	3	72	260.881	455.883	59	1.68172	0.804	8.6724	0.867647	0.59596	7107	120.458	121	74	167
1	1	3	265.891	15.1091	110	1.94985	0.671125	11.9345	0.92437	0.769231	4628	42.0727	44	33	51

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1	1	3	74	270.921	433.627	177	1.27986	0.624112	15.0121	0.917098	0.743697	9749	55.0791	55	42	69
1	1	3	75	273.484	87.2443	221	1.7298	0.815964	16.7746	0.884	0.613889	9572	43.3122	45	33	53
1	1	3	76	273.875	345.875	208	2.53252	0.91874	16.2737	0.908297	0.619048	9810	47.1635	49	36	57
1	1	3	77	281.91	395.184	468	2.04761	0.872635	24.9267	0.741611	0.530435	15133	31.0102	32	24	38
1	1	3	78	282.421	190.639	144	1.86664	0.844395	13.5406	0.718125	0.666667	7827	54.3542	56	42	68
1	1	3	79	282.361	358.084	249	2.68567	0.920094	17.8055	0.921951	0.523109	10486	42.1124	43	33	51
1	1	3	80	283.083	332.603	189	2.37673	0.898989	15.5126	0.888889	0.622222	10486	25.0952	27	20	30
1	1	3	81	283.268	332.603	112	1.49137	0.791689	11.9416	0.911298	0.820728	13462	43.2321	47	26	59
1	1	3	82	286.134	275.133	293	1.2224	0.751525	19.3147	0.890625	0.690909	4599	45.9488	47	36	56
1	1	3	83	286.947	64.0077	114	1.35831	0.759372	12.0478	0.890625	0.690909	4599	40.2544	40	31	49
1	1	3	84	294.161	204.621	124	1.31011	0.749323	12.5631	0.939394	0.826667	6013	48.4919	51	39	57
1	1	3	85	294.434	349.629	129	1.33034	0.695921	12.8159	0.802038	0.714667	6258	48.5116	51	39	58
1	1	3	86	299.056	373.056	234	1.32743	0.697635	17.4809	0.898889	0.724458	652	36.441	38	28	44
1	1	3	87	299.08	329.593	113	1.60776	0.783031	11.9948	0.898889	0.620819	5052	44.708	47	36	54
1	1	3	88	305.782	148.492	238	1.37652	0.697198	17.4018	0.929536	0.635906	10710	43	35	54	
1	1	3	89	308.422	376.07	128	1.92602	0.85465	12.1662	0.927536	0.750123	4086	38.6094	38	28	45
1	1	3	90	310.653	41.0155	323	1.64555	0.794166	20.2795	0.852252	0.621154	9693	30.0133	29	21	43
1	1	3	91	317.211	458.408	473	1.49285	0.742486	24.506	0.852252	0.621154	9693	34.1366	35	25	42
1	1	3	92	310.3	258.74	100	1.66277	0.798943	11.7838	0.900901	0.714286	4875	48.75	51	38	58
1	1	3	93	316.394	176.431	109	1.70657	0.810332	11.7838	0.939655	0.801407	4791	43.3541	46	34	54
1	1	3	94	319.03	158.242	99	1.44078	0.719907	11.2272	0.908257	0.692308	4732	47.798	49	38	58
1	1	3	95	320.597	216.664	134	1.40176	0.700768	13.0619	0.930556	0.812121	4915	36.6791	37	28	46
1	1	3	96	330.547	267.896	139	1.17331	0.523073	13.3034	0.924731	0.754366	9942	39.406	40	31	47
1	1	3	97	337.579	327.823	271	2.09271	0.878442	18.5755	0.926667	0.763736	5010	36.0432	36	28	46
1	1	3	98	333.177	395.24	192	1.71739	0.81299	15.6353	0.808955	0.6775	10198	37.631	40	29	46
1	1	3	99	331.564	104.017	172	1.60903	0.783419	14.7988	0.868778	0.627451	10244	53.3542	54	41	66
1	1	3	100	338.308	360.632	133	1.15582	0.501454	13.0131	0.921611	0.791667	5241	57.8023	60	48	69
1	1	3	101	342.452	380.048	124	1.40329	0.701558	12.5651	0.918519	0.691319	5215	42.0565	45	33	51
1	1	3	102	351.184	235.709	179	1.78723	0.828814	15.0567	0.89497	0.619377	5078	28.3687	29	22	35
1	1	3	103	349.87	267.807	161	1.21355	0.566948	14.3175	0.947059	0.825641	5106	31.7143	32	24	38
1	1	3	104	355.573	192.699	206	1.75463	0.8217	16.1953	0.919643	0.64375	7786	37.8447	38	29	47
1	1	3	105	362.143	124.473	357	1.5789	0.773864	21.3201	0.796658	0.686538	19382	54.2913	57	40	67
1	1	3	106	365.192	19.6384	177	1.28705	0.629539	15.0121	0.931579	0.743697	4816	27.209	29	21	33
1	1	3	107	364.782	79.4298	114	1.06965	0.354947	12.0478	0.912	0.730769	4537	39.7982	40	29	50
1	1	3	108	364.542	350.4	120	1.4471	0.722819	12.3608	0.944882	0.8	4689	39.075	40	32	46
1	1	3	109	368.913	285.978	46	1.8368	0.679836	7.65304	0.88461	0.638889	6786	147.522	151	117	181
1	1	3	110	380.866	338.11	127	1.10286	0.421706	12.1162	0.913669	0.751479	4777	37.6142	40	30	46
1	1	3	111	381.023	50.5496	131	1.54783	0.76328	12.9149	0.916084	0.744318	4369	33.3511	34	27	40
1	1	3	112	384.055	301.782	165	1.49453	0.74236	14.4943	0.933757	0.808824	9802	59.4061	62	48	70
1	1	3	113	386.369	106.795	195	2.07424	0.876114	15.757	0.933014	0.770751	5143	26.3744	28	19	33
1	1	3	114	398.813	384.067	134	1.35801	0.676576	13.0619	0.937063	0.812121	4920	36.7164	39	30	43
1	1	3	115	402.104	171.906	202	1.96693	0.861118	16.0373	0.918182	0.655844	5475	27.104	28	22	33
1	1	3	116	402.82	214.787	239	1.7078	0.810637	17.4443	0.895131	0.663889	13837	57.8954	58	43	74
1	1	3	117	407.701	469.368	117	1.49392	0.742919	12.2053	0.936	0.75974	4361	37.2735	39	29	46
1	1	3	118	42.597	72.0269	186	2.25991	0.896711	15.389	0.920792	0.673913	4700	25.2688	27	19	31
1	1	3	119	420.657	404.54	137	1.87173	0.845118	13.2073	0.913333	0.652381	6163	44.9854	48	36	54
1	1	3	120	421.21	210.642	100	1.77433	0.818664	11.2838	0.884956	0.666667	4125	41.25	42	32	51
1	1	3	121	421.597	210.642	67	1.37134	0.684287	11.9416	0.917808	0.697917	4008	59.8209	60	47	73
1	1	3	122	426.803	126.659	132	1.35339	0.826053	9.23618	0.923077	0.781065	4590	34.7727	35	27	43
1	1	3	123	428.429	468.696	112	1.33134	0.837524	11.9416	0.92562	0.8	4511	40.2768	42	33	48
1	1	3	124	440.678	307.668	193	1.83016	0.673829	11.9416	0.919048	0.70595	4646	24.0725	25	19	29
1	1	3	125	439.733	399.443	246	1.39449	0.656963	17.6979	0.935361	0.715298	10094	41.0325	42	32	50
1	1	3	126	439.733	202.893	75	1.92194	0.853398	9.7205	0.82093	0.568182	4292	57.2267	61	44	71
1	1	3	127	439.908	324.977	44	1.33845	0.684573	7.48482	0.956522	0.785714	6863	155.977	161	120	193
1	1	3	128	441.302	155.214	173	1.52723	0.503268	14.8415	0.90213	0.720833	4938	28.5434	30	22	35
1	1	3	129	445.397	148.147	95	1.52669	0.605533	11.9981	0.904762	0.730769	4531	47.6947	48	36	59
1	1	3	130	441.353	388.412	34	1.24166	0.592769	6.57952	0.85	0.708333	5614	165.118	176	108	219
1	1	3	131	447.062	79.8769	130	1.11577	0.443558	12.8655	0.924571	0.77381	4603	35.4077	38	28	42
1	1	3	132	449.534	47.0451	133	1.06714	0.349039	13.0131	0.904762	0.70571	4693	35.2105	36	27	41
1	1	3	133	450.026	350.36	114	1.28391	0.627186	12.0478	0.942449	0.740521	4701	41.2368	42	32	51
1	1	3	134	460.248	103.075	226	3.00305	0.942929	15.9633	0.784722	0.422221	4764	98.7288	98	70	142
1	1	3	135	461.634	476.634	71	1.27897	0.623433	9.50769	0.910236	0.788889	4260	48.5935	50	48	70
1	1	3	136	461.959	290.088	148	1.36367	0.679888	13.7273	0.936709	0.758974	5502	37.1727	38	29	44
1	1	3	137	466.043	56.1739	23	1.31472	0.649198	5.41152	0.831852	0.651143	2634	114.522	118	89	149
1	1	3	138	465.3	65.1739	20	1.20283	0.555713	5.06627	0.833333	0.666667	2430	121.5	122	87	154
1	1	3	139	474.931	370.517	87	1.77483	0.666253	10.5248	0.878788	0.66231	5493	63.1379	66	51	77
1	1	3	140	478.665	164.937	158	1.39125	0.655242	14.1835	0.929412	0.77451	6738	35.3038	36	27	40
1	1	3	141	475.295	182.409	44	1.52203	0.733875	7.48482	0.916667	0.69413	6727	132.886	136	111	188
1	1	3	142	482.725	43.554	204	1.77691	0.826609	16.1165	0.896878	0.6	9379	45.9755	48	35	59
1	1	3	143	485.162	58.085	294	1.44739	0.858085	11.3961	0.869822	0.708333	17665	60.085	62	47	72
1	1	3	144	482.755	453.941	102	1.94707	0.721431	19.3477	0.902655	0.707333	5666	55.549	56	37	71
1	1	3	145	480.108	481.45	120	1.77476	0.826146	12.3608	0.909091	0.691818	4258	35.4833	36	27	43
1	1	3	146	483.899	116.449	158	1.2289	0.581235	14.1835	0.918605	0.70537	4655	29.462	30	22	36
1	1	3	147	496.56	345.393	298	1.53534	0.758803	15.4788	0.792553	0.627368	9905	33.2383	35	25	41
1	1															

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1	3	150	491.686	286.086	35	1.18938	0.541385	6.67558	0.945946	0.833333	3545	101.286	105	89	117
1	3	151	487.438	76.3769	130	2.04206	0.871891	12.8655	0.902778	0.671255	4553	35.0231	36	26	43
1	3	152	499.836	444.508	128	1.24075	0.591564	12.7662	0.920863	0.711111	4856	37.9375	39	30	46
1	3	153	504.436	285.462	39	1.4304	0.715017	7.04673	0.906977	0.8125	3680	94.3559	96	79	113
1	4	1	20	122.671	152	1.3561	0.675449	13.9116	0.921212	0.730769	4832	31.7895	33	25	39
1	4	2	22.2031	72.3198	197	1.33473	0.662327	15.6376	0.923245	0.72963	9490	48.1726	50	30	46
1	4	3	148.043	115	1.35777	0.676433	12.1005	0.92	0.746753	0.511	35.2261	40	30	46	48
1	4	4	23.2774	297.023	137	1.68849	0.800492	13.2013	0.931973	0.905882	6042	44.1022	47	35	53
1	4	5	26.6066	368.245	151	1.68849	0.800492	13.6658	0.905639	0.699074	7260	48.0795	50	38	57
1	4	6	182.5294	182.529	102	1.28239	0.626493	11.5961	0.93578	0.784615	4532	44.4314	45	36	53
1	4	7	36.734	487.684	282	2.48224	0.888834	18.5467	0.817391	0.592437	9658	34.2482	35	26	41
1	4	8	39.2931	188.77	183	2.36982	0.906608	15.2644	0.821351	0.413555	15415	26.0939	27	19	31
1	4	9	49.5199	217.316	377	2.30967	0.939086	21.9092	0.821351	0.413555	15415	26.0939	27	19	31
1	4	10	40.2109	306.084	119	1.46635	0.771385	12.5092	0.923688	0.793333	4745	38.8739	41	29	43
1	4	11	45.8224	124.27	259	2.13833	0.883911	18.1595	0.799383	0.535124	10090	38.5515	41	30	46
1	4	12	53.6559	76.3118	186	1.22662	0.579108	15.389	0.944162	0.781513	9459	50.9086	53	42	60
1	4	13	61.75	496.487	156	1.3807	0.689518	14.0933	0.928571	0.764706	6401	41.0321	42	29	54
1	4	14	61.8438	100.813	96	1.5645	0.769055	11.0558	0.897196	0.671329	4500	46.875	49	38	56
1	4	15	70.6453	190.465	172	2.30563	0.901047	14.7986	0.900524	0.532508	5838	33.9419	35	27	41
1	4	16	69.6914	97.7778	81	1.43608	0.717712	10.1554	0.9	0.75	4431	54.7037	58	43	65
1	4	17	87.8529	100.461	102	1.86101	0.843364	11.3961	0.894737	0.708333	4364	42.7843	46	33	52
1	4	18	89.9259	88.148	108	1.14834	0.491595	11.7265	0.915254	0.755245	4387	40.6204	43	33	46
1	4	19	98.8842	183.474	190	2.31245	0.901662	15.5536	0.92233	0.688406	7736	40.7158	42	32	49
1	4	20	98.8446	473.239	251	1.39113	0.695175	17.8769	0.933086	0.747024	10787	42.9761	46	34	51
1	4	21	96.8018	353.613	111	1.68667	0.805287	11.8882	0.917355	0.74	4686	42.2162	44	33	51
1	4	22	96.6612	405.521	121	1.31338	0.648287	12.4122	0.916667	0.785714	4595	37.9752	41	29	46
1	4	23	98.7228	41.5248	101	1.22405	0.576693	11.3401	0.90991	0.765152	4325	42.8218	44	33	52
1	4	24	100.188	110.136	176	1.48194	0.738011	14.9696	0.926316	0.739496	5059	28.7443	29	22	36
1	4	25	101.765	300.07	115	1.86325	0.843776	12.1005	0.884615	0.589744	4560	39.6522	41	31	49
1	4	26	108.133	141.793	135	1.66071	0.33452	13.1106	0.918367	0.741758	4866	36.0444	36	28	45
1	4	27	118.875	43.208	48	2.28411	0.899069	7.81764	0.774194	0.623377	5782	120.458	127	74	168
1	4	28	124.705	39.2679	112	1.95296	0.85896	11.9416	0.88189	0.622222	4393	39.1339	41	31	47
1	4	29	123.518	39.373	110	1.6515	0.769275	11.8345	0.92437	0.705128	4488	40.8	43	33	49
1	4	30	123.016	410.445	128	1.20716	0.560153	12.7662	0.907801	0.761905	4694	36.6719	37	29	45
1	4	31	135.864	109.582	125	1.35859	0.676922	12.6157	0.925926	0.757576	4636	37.088	38	20	45
1	4	32	135.864	109.582	182	1.19873	0.551436	15.2227	0.928571	0.764706	5123	28.1484	29	22	34
1	4	33	140.518	124.695	164	1.68308	0.804354	14.4503	0.921348	0.759259	4966	30.2195	31	24	36
1	4	34	141.5	164.779	104	1.25753	0.606338	11.5073	0.912281	0.722222	4404	42.3462	44	35	50
1	4	35	151.336	265.602	129	1.35544	0.675056	12.7662	0.907801	0.711111	4698	36.7031	39	30	44
1	4	36	154.318	473.529	116	1.65981	0.798134	14.1386	0.928994	0.654167	4848	30.879	31	25	38
1	4	37	157.259	431.776	116	1.73133	0.816326	12.153	0.892308	0.544444	4545	35.181	38	29	49
1	4	38	157.259	292.536	140	1.53578	0.758963	13.3512	0.915033	0.723167	4828	34.4857	35	27	43
1	4	39	160.654	143.442	155	1.03336	0.252051	14.0915	0.923077	0.742857	9609	61.5962	64	49	73
1	4	40	163.455	143.442	121	1.71923	0.813431	12.4122	0.866296	0.664835	4553	37.6281	39	29	46
1	4	41	164.635	451.9079	63	1.2572	0.815312	8.95633	0.913043	0.63	7016	111.365	116	91	136
1	4	42	169.361	331.11	82	1.63975	0.732517	10.2193	0.87234	0.621212	4015	49.6951	52	40	60
1	4	43	167.286	389.7735	98	1.61962	0.706627	11.2704	0.862883	0.7	4307	43.943	45	35	52
1	4	44	171.588	93.6129	341	2.5791	0.921772	20.8359	0.833741	0.545833	14549	43.8387	45	33	55
1	4	45	170.717	230.678	87	1.21387	0.566864	10.3248	0.815769	0.793093	4778	54.9195	56	43	66
1	4	46	172.598	433.169	130	1.4418	0.72038	12.8855	0.815493	0.714286	4816	27.0462	27	29	46
1	4	47	182.654	195.457	81	1.03532	0.259957	10.1594	0.94166	0.61	4816	59.6388	60	45	71
1	4	48	188.789	451.247	194	1.86937	0.844891	15.7165	0.941748	0.734868	5034	26.0315	27	20	32
1	4	49	197.623	222.729	579	1.57599	0.772905	17.1515	0.772	0.486555	24028	41.9391	42	31	53
1	4	50	207.162	275.591	154	1.34856	0.670916	14.0028	0.933333	0.802083	7416	46.1558	51	37	56
1	4	51	208.366	19.4718	142	1.39993	0.699817	13.4462	0.922078	0.795593	4462	31.4225	32	24	39
1	4	52	216.594	153.421	254	1.67351	0.801835	17.9834	0.897527	0.636591	12587	49.5551	51	37	62
1	4	53	216.26	292.683	123	1.23562	0.587384	12.5143	0.911111	0.732143	7499	60.9675	63	51	73
1	4	54	223.36	332.144	125	1.04882	0.425139	12.6157	0.93985	0.801282	4674	37.392	38	29	44
1	4	55	224.5	17	8	1.19323	0.547723	3.19154	0.8	0.666667	82	10.25	11	6	14
1	4	56	235.095	181.581	241	2.2866	0.899301	17.5172	0.816806	0.617949	7444	30.888	32	22	39
1	4	57	230.172	402.352	128	1.20362	0.556529	12.7662	0.907801	0.65641	5212	40.7188	41	31	50
1	4	58	236.018	79.3832	167	1.40843	0.704192	14.5819	0.922652	0.795656	4591	27.4311	29	22	33
1	4	59	238.919	345.641	117	1.271	0.617231	12.2053	0.928571	0.759714	4616	39.453	41	30	48
1	4	60	241.222	378.832	81	1.37505	0.686378	10.1554	0.89011	0.75	6038	74.5432	78	59	87
1	4	61	252.157	247.61	385	3.61941	0.961075	22.1404	0.619149	0.49359	11357	29.4987	31	23	36
1	4	62	259.684	354.2	95	1.16027	0.507128	10.9981	0.89785	0.719697	4295	45.2105	47	38	54
1	4	63	268.622	143.438	315	1.63168	0.837859	20.0267	0.791457	0.686275	9714	30.8381	33	24	37
1	4	64	272.363	234.879	256	1.57039	0.717041	18.0541	0.911032	0.701111	8719	34.1758	34	28	42
1	4	65	271.957	243.086	93	1.42886	0.71428	10.8617	0.894231	0.701545	4324	46.4946	47	36	57
1	4	66	275.355	27.2211	139	1.5235	0.754559	15.9177	0.935881	0.690972	4521	22.7186	24	18	27
1	4	67	278.804	327.134	97	1.56125	0.644168	11.132	0.86178	0.698718	5405	49.5872	50	37	63
1	4	68	278.598	102.332	109	1.46495	0.730775	11.7806	0.864178	0.698718	5405	42.8252	40	37	63
1	4	69	289.534	305.602	103	1.37098	0.684081	11.4318	0.867931	0.720231	4411	35.6207	36	27	46
1	4	70	289.613	488.525	261	2.99776	0.942721	18.2295	0.862941	0.466071	9237	115.618	120	142	162
1	4	71	1.69925	0.8085	8.66628	0.873016	0.611111	6359	0.932203	0.75	5053	30.6242	32	24	38
1	4	72	280.576	78.3273	165	1.96088	0.460189	11.4943							

1	1	308.012	29.4471	170	1.2847	0.62778	14.7123	0.909091	0.674603	4598	27.0471	28	21	33
2	1	1.97041	0.861646	126	1.47855	0.768264	18.4724	0.911585	0.679545	4180	35.5556	38	28	43
3	1	1.47855	0.768264	299	1.56218	0.768264	18.4724	0.911585	0.679545	20353	68.0702	71	55	81
4	1	1.56218	0.768264	268	1.80655	0.768264	18.4724	0.911585	0.679545	9821	36.6455	39	27	46
5	1	1.80655	0.768264	169	1.63076	0.768264	18.4724	0.911585	0.679545	7397	43.7692	46	35	52
6	1	1.63076	0.768264	119	1.51786	0.768264	18.4724	0.911585	0.679545	39.3109	41	29	48	
7	1	1.51786	0.768264	123	1.87432	0.768264	18.4724	0.911585	0.679545	37.6016	39	30	44	
8	1	1.87432	0.768264	356	2.05856	0.768264	18.4724	0.911585	0.679545	46.262	45	32	53	
9	1	2.05856	0.768264	233	1.26679	0.768264	18.4724	0.911585	0.679545	15309	42.7628	35	33	
10	1	1.26679	0.768264	160	1.13385	0.768264	18.4724	0.911585	0.679545	28.4592	41	29	48	
11	1	1.13385	0.768264	151	1.57445	0.768264	18.4724	0.911585	0.679545	30.9609	33	24	38	
12	1	1.57445	0.768264	138	1.27551	0.768264	18.4724	0.911585	0.679545	37.0875	39	29	45	
13	1	1.27551	0.768264	117	1.43907	0.768264	18.4724	0.911585	0.679545	35.7847	36	26	41	
14	1	1.43907	0.768264	225	1.25277	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
15	1	1.25277	0.768264	86	1.2873	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
16	1	1.2873	0.768264	190	1.89957	0.768264	18.4724	0.911585	0.679545	35.7847	36	26	41	
17	1	1.89957	0.768264	186	1.61906	0.768264	18.4724	0.911585	0.679545	39.453	41	31	47	
18	1	1.61906	0.768264	111	1.65096	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
19	1	1.65096	0.768264	229	1.36656	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
20	1	1.36656	0.768264	77	1.74772	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
21	1	1.74772	0.768264	356	1.35563	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
22	1	1.35563	0.768264	73	2.4258	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
23	1	2.4258	0.768264	161	1.17547	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
24	1	1.17547	0.768264	67	2.86142	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
25	1	2.86142	0.768264	107	1.4179	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
26	1	1.4179	0.768264	144	1.43449	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
27	1	1.43449	0.768264	106	1.43937	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
28	1	1.43937	0.768264	188	2.88936	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
29	1	2.88936	0.768264	116	1.445	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
30	1	1.445	0.768264	120	1.48149	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
31	1	1.48149	0.768264	120	1.7764	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
32	1	1.7764	0.768264	172	1.30643	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
33	1	1.30643	0.768264	130	1.20377	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
34	1	1.20377	0.768264	142	2.62376	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
35	1	2.62376	0.768264	152	1.08287	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
36	1	1.08287	0.768264	205	1.45531	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
37	1	1.45531	0.768264	245	1.83314	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
38	1	1.83314	0.768264	152	1.50055	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
39	1	1.50055	0.768264	309	1.7151	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
40	1	1.7151	0.768264	145	1.25774	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
41	1	1.25774	0.768264	169	1.32558	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
42	1	1.32558	0.768264	114	1.38677	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
43	1	1.38677	0.768264	121	1.68226	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
44	1	1.68226	0.768264	111	1.28116	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
45	1	1.28116	0.768264	222	1.69922	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
46	1	1.69922	0.768264	103	1.47235	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
47	1	1.47235	0.768264	222	1.33284	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
48	1	1.33284	0.768264	199	1.15958	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
49	1	1.15958	0.768264	126	1.09487	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
50	1	1.09487	0.768264	134	1.46864	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
51	1	1.46864	0.768264	141	1.06579	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
52	1	1.06579	0.768264	130	1.52309	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
53	1	1.52309	0.768264	107	1.68073	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
54	1	1.68073	0.768264	166	1.37201	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
55	1	1.37201	0.768264	106	1.52953	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
56	1	1.52953	0.768264	180	1.7102	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
57	1	1.7102	0.768264	142	1.17952	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
58	1	1.17952	0.768264	102	1.41567	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
59	1	1.41567	0.768264	95	1.75797	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
60	1	1.75797	0.768264	144	1.34308	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
61	1	1.34308	0.768264	147	1.24309	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
62	1	1.24309	0.768264	178	1.07119	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
63	1	1.07119	0.768264	114	1.42193	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
64	1	1.42193	0.768264	233	1.23241	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
65	1	1.23241	0.768264	144	1.65526	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
66	1	1.65526	0.768264	168	1.42453	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
67	1	1.42453	0.768264	108	1.53037	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
68	1	1.53037	0.768264	97	1.67721	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
69	1	1.67721	0.768264	148	1.8642	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
70	1	1.8642	0.768264	180	1.84276	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
71	1	1.84276	0.768264	133	1.7752	0.768264	18.4724	0.911585	0.679545	43.6622	45	32	54	
72	1	1.7752	0.768264	685										

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1	1	5	36	244.883	44.7186	334	1.70555	0.910104	0.602219	0.885942	0.703159	15694	46.988	49	38	55
1	1	5	37	246.434	115.89	145	1.57559	0.772711	13.5815	0.517122	0.697115	1689	32.3379	33	25	39
1	1	5	38	245.763	44.532	173	1.4535	0.725714	14.8415	0.505759	0.686208	222	51.711	56	44	64
1	1	5	39	259.865	297.804	148	1.74551	0.819627	13.7273	0.907975	0.669883	8158	41.6881	44	33	50
1	1	5	40	265.892	35.5	186	1.69253	0.806796	15.389	0.925373	0.645833	7714	41.4731	44	34	53
1	1	5	41	267.611	474.64	288	1.69734	0.808018	19.1492	0.857143	0.626087	12451	43.2326	45	33	53
1	1	5	42	276.033	256.171	152	1.66024	0.798253	13.9116	0.851018	0.703704	6365	41.875	44	34	43
1	1	5	43	268.878	481.764	123	1.8018	0.831849	12.5143	0.917951	0.903922	4486	36.4715	38	29	43
1	1	5	44	295.075	442.753	146	1.6856	0.805009	13.6343	0.918239	0.737374	5784	39.2055	40	30	46
1	1	5	45	300.664	479.541	122	1.79398	0.830231	12.4634	0.917293	0.797386	4489	36.7951	39	30	43
1	1	5	46	318.606	113.228	254	1.95525	0.859316	17.9834	0.830065	0.574661	10021	39.4528	42	31	47
1	1	5	47	316.634	410.756	131	1.27616	0.821266	12.9149	0.89726	0.668367	18741	60.145	63	48	62
1	1	5	48	334.634	418.425	391	1.88512	0.732318	22.3123	0.807851	0.555698	18741	47.9309	47	36	62
1	1	5	49	339.359	87.0629	143	1.88512	0.827704	13.4935	0.910828	0.752632	4653	32.5385	34	27	38
1	1	5	50	346.493	100.553	219	2.21567	0.992357	16.6985	0.943966	0.796364	5193	23.7123	24	19	29
1	1	5	51	348.328	442.77	174	2.1567	0.892357	16.6985	0.943966	0.796364	5193	36.592	37	30	44
1	1	5	52	356.336	138.177	232	1.8871	0.848032	14.8843	0.935484	0.725	6367	22.375	24	18	27
1	1	5	53	363.332	178.751	265	1.6527	0.798621	18.3687	0.862288	0.752841	11544	43.5623	45	36	52
1	1	5	54	368.601	52.3114	228	1.73712	0.817686	17.0382	0.919355	0.633333	9439	41.3991	43	33	50
1	1	5	55	372.872	19.7934	213	1.41274	0.704369	16.4682	0.938326	0.747368	9210	43.2394	44	32	54
1	1	5	56	374.975	117.607	160	1.29951	0.636622	13.8198	0.943396	0.78125	4077	32.5133	34	27	38
1	1	5	57	374.303	311.118	152	1.15034	0.694272	13.9116	0.921212	0.77551	4807	31.625	32	26	36
1	1	5	58	377.6	366.522	113	1.84936	0.726189	12.1005	0.912698	0.737179	4437	38.5826	40	30	46
1	1	5	59	378.921	363.124	266	1.84987	0.841294	13.4033	0.865332	0.738889	9083	37.1541	39	29	44
1	1	5	60	384.396	288.143	230	2.04748	0.874617	17.1127	0.935185	0.765132	9567	56.0043	38	29	44
1	1	5	61	385.282	432.842	202	1.86235	0.820613	13.3034	0.945425	0.770833	9666	37.166	38	30	45
1	1	5	62	410.504	429.727	139	1.74983	0.820613	13.3034	0.945425	0.770833	9666	37.166	38	30	45
1	1	5	63	411.49	466.68	259	1.41752	0.708752	18.1595	0.945425	0.770833	9666	37.166	38	30	45
1	1	5	64	422.424	175.104	328	1.81488	0.834505	20.4358	0.945425	0.770833	9666	37.166	38	30	45
1	1	5	65	443.127	154.822	353	1.61841	0.786264	21.2003	0.822844	0.613913	12182	34.3099	36	25	42
1	1	5	66	440.34	90.6832	257	1.37459	0.686118	16.0373	0.897778	0.701389	9021	44.6584	47	35	54
1	1	5	67	454.759	375.696	257	2.76159	0.941862	18.0893	0.859532	0.494231	9329	36.2996	38	27	43
1	1	5	68	452.566	444.485	136	1.59497	0.779044	13.159	0.92517	0.708333	4269	31.3897	33	25	38
1	1	5	69	464.612	335.218	294	1.32695	0.657325	19.3477	0.830508	0.608696	15405	32.398	55	40	63
1	1	5	70	468.948	264.647	326	1.6291	0.789433	20.3734	0.91573	0.686316	18203	55.8374	58	45	66
1	1	5	71	465.042	44.1354	96	1.9317	0.855575	11.0558	0.90566	0.623377	3616	37.6667	39	29	46
1	1	5	72	471.12	211.108	251	1.78261	0.827833	17.8769	0.922794	0.747024	9386	37.3944	39	30	45
1	1	5	73	466.162	66.9279	111	1.23308	0.585076	11.8882	0.908836	0.720779	4120	37.1171	39	29	45
1	1	5	74	472.917	140.042	168	1.49961	0.691246	13.6433	0.929336	0.658824	5693	30.1507	32	25	36
1	1	5	75	472.007	452	166	1.38385	0.691246	13.6433	0.929336	0.658824	5693	30.1507	32	25	36
1	1	5	76	480.38	161.804	158	1.088	0.393983	14.1835	0.923977	0.752381	6223	39.3861	43	31	46
1	1	5	77	483.022	324.5	228	1.49614	0.743814	17.0382	0.926829	0.705882	9761	42.8114	45	31	53
1	1	5	78	480.088	485.956	113	1.31461	0.649128	11.9948	0.918699	0.733766	4129	37.3363	39	30	44
1	1	5	79	484.238	427.325	126	1.78479	0.828297	12.666	0.926471	0.642857	4172	33.1111	35	27	40
1	1	5	80	488.556	365.677	124	1.60356	0.781734	12.5651	0.898551	0.632653	4430	35.7258	37	28	44
1	1	5	81	492.935	486.839	124	1.7483	0.820264	12.5651	0.925373	0.810458	4449	35.879	37	31	41
1	1	5	82	500.688	443.375	112	1.26825	0.615051	11.9416	0.896	0.717949	4260	38.0357	40	29	46
1	1	6	1	13.3247	32.0206	134	1.80457	0.83417	15.7165	0.899908	0.577381	5416	27.9175	30	20	35
1	1	6	2	10.9224	265.724	116	1.37589	0.686848	12.153	0.920635	0.763247	4490	38.7069	39	29	48
1	1	6	3	18.9744	454.487	117	1.20659	0.559577	12.2053	0.914063	0.692308	3922	33.5214	34	26	41
1	1	6	4	27.2042	342.218	142	1.54653	0.76282	13.4462	0.934211	0.759358	4693	33.0493	35	26	40
1	1	6	5	27.2273	355.023	220	1.04045	0.276128	16.7366	0.92437	0.718954	8697	39.518	41	31	48
1	1	6	6	33.1343	143.023	499	1.06618	0.546716	25.2051	0.799679	0.547045	24853	49.8056	46	36	68
1	1	6	7	42.9668	116.072	152	1.23666	0.590105	13.5116	0.850593	0.580247	8627	31.5326	32	25	38
1	1	6	8	46.016	262.755	188	2.09621	0.818875	13.4716	0.918455	0.715719	9014	42.1415	44	33	51
1	1	6	9	55.7664	473.964	214	1.83381	0.838233	16.5068	0.866957	0.728571	4113	42.1415	44	33	51
1	1	6	10	54.8431	308.078	102	1.43966	0.719387	11.3961	0.866957	0.728571	4113	51.8193	53	38	65
1	1	6	11	63.0966	31.486	321	1.12537	0.45869	20.2166	0.865229	0.663223	16634	29.5944	31	24	36
1	1	6	12	59.014	79.3497	143	1.91324	0.852532	13.4935	0.928571	0.722222	4232	26.1988	27	20	32
1	1	6	13	60.8614	420.223	166	1.50226	0.746252	14.5381	0.937853	0.751131	4349	44.0203	45	34	55
1	1	6	14	65.6294	230.122	197	1.33788	0.698748	15.8376	0.938095	0.781746	8672	30.3043	32	23	36
1	1	6	15	66.0072	459.725	118	1.08514	0.388889	13.2555	0.926174	0.758642	4182	36.0169	37	29	43
1	1	6	16	100.5	100.5	118	1.41026	0.70512	12.2573	0.921875	0.786667	4250	47.5791	46	34	63
1	1	6	17	82.3861	153.073	316	2.04524	0.872317	20.0585	0.890141	0.681034	15035	37.14929	33	26	37
1	1	6	18	74.5	76.3	140	1.2011	0.553925	13.3512	0.927152	0.777778	4409	35.8067	37	28	44
1	1	6	19	75.0336	296.849	119	1.4162	0.741988	12.3092	0.924881	0.721212	4261	32.3953	34	25	39
1	1	6	20	95.0343	217.457	129	1.11079	0.435322	12.8159	0.934783	0.763314	4179	35.5478	36	28	43
1	1	6	21	96.313	242.878	115	1.36483	0.680563	12.1005	0.912698	0.746753	4088	25.1274	26	19	32
1	1	6	22	91.5352	279.803	71	1.39377	0.558893	9.50789	0.922078	0.806818	7242	39.656	42	32	48
1	1	6	23	96.1847	83	125	1.38708	0.692999	14.1386	0.928994	0.747619	3945	25.1274	26	19	32
1	1	6	24	105.341	129.121	91	1.30868	0.645047	12.6157	0.919118	0.757576	4957	35.478	36	28	43
1	1	6	25	109.549	347.043	162	2.17195	0.887703	10.7641	0.919118	0.757576	4957	25.1274	26	19	32
1	1	6	26	109.549	347.043	162	2.17195	0.887703	10.7641	0.919118	0.757576	4957	25.1274	26	19	32
1	1	6	27	118.701	107.464	57	1.8889	0.683657	14.3619	0.905028	0.736364	4389	27.0826	28	21	34
1	1	6	28	124.658	17.465											

1	1	30	132.584	470.016	250	1.71834	0.813219	17.8412	0.923168	0.657895	5098	20.392	21	16	25
1	1	31	128.47	178.226	115	1.36792	0.882339	12.1005	0.891473	0.696397	4161	36.1826	38	28	44
1	1	32	133.392	231.248	153	1.70893	0.810918	13.9573	0.910714	0.708333	4000	28.7582	29	22	35
1	1	33	129.828	261.081	99	1.51368	0.750701	11.2272	0.9	0.692308	4268	43.1111	45	34	51
1	1	34	132.862	376.505	196	1.68408	0.804616	15.7973	0.806584	0.640523	9241	47.118	49	37	59
1	1	35	136.261	415.62	171	1.80258	0.78143	14.7555	0.909574	0.678571	3872	23.2281	24	18	28
1	1	36	133.941	132	118	1.86562	0.841131	12.2253	0.914729	0.670455	4024	34.1017	36	26	42
1	1	37	143.395	40.8098	205	2.49632	0.813252	11.1559	0.923423	0.673912	4016	22.4195	24	17	28
1	1	38	136.271	497.308	107	1.36188	0.823242	11.672	0.859182	0.673912	4016	37.5327	38	28	47
1	1	39	141.448	248.271	161	1.38148	0.889446	11.1808	0.918782	0.709804	8458	46.7293	47	37	57
1	1	40	153.392	90.6022	181	1.20958	0.562599	15.1808	0.932299	0.760504	8163	45.0594	47	37	57
1	1	41	155.006	138.468	173	1.63706	0.791746	14.8415	0.910526	0.720833	7860	44.2775	45	35	53
1	1	42	154.19	371.076	105	1.87167	0.711469	11.5624	0.9375	0.777778	4329	43.1333	43	35	50
1	1	43	158.17	311.535	159	1.82167	0.835858	14.2283	0.913793	0.722727	4453	42.1753	45	35	50
1	1	44	163.866	193.575	73	1.13584	0.643091	11.1132	0.92381	0.746154	4091	31.5589	32	26	39
1	1	45	163.836	463.971	105	1.30539	0.642774	11.5624	0.905172	0.734266	4096	39.0095	40	30	40
1	1	46	164.629	171.1358	81	1.08668	0.410546	10.1554	0.89011	0.736364	3960	49.1358	50	40	60
1	1	47	168.383	77.1358	81	1.48321	0.738536	10.8817	0.93	0.704545	3451	37.1075	39	30	43
1	1	48	171.794	405.146	126	1.15273	0.89743	12.666	0.933333	0.807692	3872	30.7302	32	24	37
1	1	49	171.994	480.986	142	1.38735	0.693144	13.4462	0.910256	0.682692	4317	30.4014	31	24	37
1	1	50	171.641	492.672	128	1.87546	0.845987	12.7662	0.895105	0.627451	4145	32.3828	34	25	40
1	1	51	173.671	433.735	102	1.35599	0.675379	16.0769	0.931193	0.751852	8986	44.266	46	34	53
1	1	52	185.302	433.735	102	1.81242	0.81401	11.3961	0.87931	0.60385	4289	42.049	43	31	54
1	1	53	185.608	86.8987	237	2.78837	0.931981	17.3712	0.792642	0.50661	8974	37.865	41	29	47
1	1	54	194.827	300.864	162	1.81442	0.834412	14.3619	0.836416	0.77512	4457	27.5123	28	21	34
1	1	55	196.489	333.925	282	1.85588	0.842417	18.9487	0.88125	0.582645	9826	34.844	37	28	42
1	1	56	197.333	198.188	69	1.37758	0.68779	9.3702	0.907895	0.784091	2189	31.7246	33	24	39
1	1	57	197.394	480.986	142	1.38735	0.693144	13.4462	0.910256	0.682692	4317	30.4014	31	24	37
1	1	58	198.995	14.0349	172	1.53598	0.758998	14.7396	0.919786	0.671875	8451	49.1337	51	40	60
1	1	59	203.68	182.922	103	1.19441	0.546851	11.4518	0.927928	0.780303	4291	41.6602	44	34	50
1	1	60	203.9	144.811	90	1.15094	0.494473	10.7047	0.909091	0.743802	4030	44.7778	47	35	54
1	1	61	208.575	113.591	127	1.45916	0.467075	12.7162	0.894366	0.697802	4249	33.4567	37	25	43
1	1	62	211.252	442.087	127	1.63752	0.763752	12.7162	0.907143	0.721591	4218	33.2126	35	26	40
1	1	63	216.464	44.7969	192	1.19242	0.5447	15.6353	0.923077	0.705882	8652	45.0625	46	35	57
1	1	64	217.939	175.412	148	1.21036	0.863371	13.7273	0.930818	0.704762	6994	47.2568	50	39	57
1	1	65	216.628	205.718	184	1.70315	0.803629	14.4503	0.921348	0.784689	5629	34.3232	36	28	40
1	1	66	218.676	394.858	204	2.15034	0.885288	16.1165	0.910714	0.63354	4637	22.7304	24	18	27
1	1	67	220.965	500.827	104	1.29582	0.635975	11.5073	0.827571	0.722222	4228	40.6538	42	31	49
1	1	68	229.603	236.44	136	1.42968	0.714626	13.159	0.877419	0.653846	3947	29.0221	30	22	36
1	1	69	228.632	467.226	106	1.38212	0.690294	11.6174	0.890758	0.688312	4010	37.8302	39	31	46
1	1	70	240.147	245.049	143	2.58519	0.920885	13.4935	0.89375	0.525735	4059	28.3846	29	21	37
1	1	71	238.28	84.892	83	1.70592	0.70592	10.28	0.892979	0.709402	4079	49.1446	50	38	61
1	1	72	244.539	88.3106	143	1.38206	0.580813	13.4935	0.916667	0.744792	4294	30.028	31	23	37
1	1	73	231.232	18.672	125	1.28306	0.580836	12.657	0.905797	0.744048	4150	33.2	34	27	40
1	1	74	231.463	308.268	90	1.61102	0.789594	10.0525	0.909091	0.740741	3944	49.3	51	39	61
1	1	75	257.025	41.1698	159	1.56294	0.76839	14.2283	0.928825	0.80303	4305	27.0755	28	21	33
1	1	76	259.014	278.879	140	1.7842	0.823835	13.3512	0.915033	0.625	4146	29.6143	31	22	37
1	1	77	259.368	332.333	87	1.40256	0.701183	10.5248	0.897755	0.733728	4215	33.5918	36	28	42
1	1	78	259.629	167.366	124	1.03654	0.263166	12.5651	0.911765	0.733728	4215	33.5918	36	28	42
1	1	79	269.735	297.283	113	1.35843	0.676824	11.9948	0.904	0.733728	3856	34.1239	35	26	42
1	1	80	273.347	97.7288	118	1.47584	0.737133	12.2573	0.880597	0.68832	3983	33.7842	35	26	42
1	1	81	271.644	125.856	118	1.90244	0.850706	12.2573	0.893939	0.670455	3988	33.7866	35	26	42
1	1	82	281.493	495.375	296	2.40868	0.909746	19.4134	0.902439	0.560606	18228	38.5177	40	31	47
1	1	83	288.973	400.997	367	2.92475	0.939733	21.6166	0.882212	0.50551	14136	38.5177	40	31	47
1	1	84	280.48	201.636	125	1.10917	0.426221	12.6157	0.932836	0.801282	4211	33.688	35	26	41
1	1	85	289.615	433.561	96	1.49853	0.744771	11.0558	0.90566	0.738462	4561	47.5104	50	37	56
1	1	86	293.635	475.985	66	1.19599	0.548538	9.167	0.90411	0.733333	7232	109.576	112	84	134
1	1	87	299.794	390.016	126	2.50588	0.916924	12.666	0.9	0.736942	4331	34.373	35	26	43
1	1	88	304.173	264.688	301	1.1756	0.545765	19.5766	0.847887	0.651515	18051	59.9701	61	47	74
1	1	89	301.379	169.345	87	1.32239	0.644335	10.5248	0.90625	0.725	3930	45.1724	46	33	51
1	1	90	306.688	432.152	112	1.39275	0.696038	11.9416	0.903226	0.717949	4786	42.7321	45	33	51
1	1	91	305.333	335.758	33	1.52246	0.754039	6.48204	0.916667	0.673469	5489	166.303	170	138	199
1	1	92	310.047	193.959	128	1.81317	0.834161	12.7662	0.914286	0.609524	4232	33.0625	35	26	39
1	1	93	310.465	48.1628	129	1.19976	0.525215	12.8159	0.889655	0.661538	4033	31.2636	33	24	37
1	1	94	319.884	465.903	124	1.20666	0.63221	12.5651	0.925373	0.733728	4261	34.3629	35	26	42
1	1	95	325.932	374.111	235	1.86	0.843179	17.2577	0.925197	0.658263	8846	37.6426	39	29	47
1	1	96	324.01	431.628	87	1.30457	0.642199	10.5248	0.915789	0.725	4236	48.6897	51	41	56
1	1	97	323.081	446.453	66	1.70754	0.810574	10.4642	0.934783	0.826623	4283	49.8023	51	42	59
1	1	98	331.326	24.2654	243	2.48442	0.910948	17.5897	0.815436	0.54	8882	36.5514	37	27	45
1	1	99	331.621	91.5446	112	2.48442	0.92387	11.5816	0.918033	0.566567	4149	37.0415	39	30	43
1	1	100	332.461	151.078	128	1.38632	0.62587	12.7662	0.91601	0.711111	7159	60.5172	62	49	74
1	1	101	335.986	222.69	142	1.72168	0.679607	12.7662	0.934211	0.788889	4647	32.7254	34	26	39
1	1	102	350.636	153.236	110	1.39529	0.697386	11.8345	0.901639	0.714286	4340	39.4515	40	30	43
1	1	103	354.773	470.773	128	1.72519	0.818669	12.7662	0.927536	0.711111	4253	33.2266	34	25	41
1	1	104	356.548	484.774	217	1.67429	0.80204	16.6221	0.923408	0.788741	9279	42.7604	44	34	53
1	1	105	357.339	292.358	118	1.22631	0.576819	12.2573	0.914729	0.702381	4199	35.5847	37	28	44

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1	1	106	359.018	312.35	114	1.78064	0.827412	12.0478	0.897638	0.626374	4181	36.6754	38	28	45
1	1	107	361.744	155.031	129	1.60135	0.781048	12.8159	0.908451	0.661538	7536	58.4186	60	46	71
1	1	108	370.422	126.786	112	1.32766	0.66247	11.9416	0.903226	0.739489	4218	37.6507	41	34	46
1	1	109	379.586	104.258	97	1.12577	0.569727	11.1132	0.898148	0.717848	4144	42.7216	44	34	51
1	1	110	382.722	804.684	187	1.174628	0.820259	15.4304	0.932195	0.611111	8630	46.1497	48	36	57
1	1	111	388.56	193.188	303	1.182054	0.835633	15.6416	0.937186	0.63115	13210	50.2376	52	39	61
1	1	112	387.155	337.23	174	1.175594	0.821955	13.159	0.894737	0.742546	8757	50.2376	52	39	61
1	1	113	384.868	261.441	136	1.168261	0.804233	13.159	0.866109	0.613333	13644	47.5459	50	32	61
1	1	114	401.428	202.432	114	1.151997	0.753099	12.5991	0.825466	0.636752	5411	36.3154	38	29	44
1	1	115	399.517	232.944	149	1.204919	0.872845	13.7736	0.925466	0.601881	9995	26.0286	27	20	32
1	1	116	414.593	273.039	384	1.249901	0.748901	22.1116	0.829374	0.601881	9995	26.0286	27	20	32
1	1	117	424.434	170.7862	159	1.16314	0.790105	14.2283	0.940828	0.80303	4592	28.8905	29	22	35
1	1	118	429	16	109	1.24326	0.594169	11.7806	0.931624	0.80303	4592	28.8905	29	22	35
1	1	119	434.508	178.295	132	1.690966	0.809666	12.9641	0.923077	0.733333	4152	31.4545	33	25	38
1	1	120	442.846	371.2	395	1.684333	0.80468	22.4461	0.923077	0.733333	4152	31.4545	33	25	38
1	1	121	435.648	108.209	91	1.142734	0.713551	10.7641	0.91	0.727778	4284	41.3626	43	33	51
1	1	122	439.969	245.641	131	1.74057	0.818488	12.9419	0.891156	0.727778	4284	41.3626	43	33	51
1	1	123	444.345	472.391	110	1.52612	0.755407	11.8345	0.92437	0.785714	4269	38.8091	40	29	47
1	1	124	447.904	87.8989	178	1.58428	0.775618	15.0545	0.92228	0.669173	4498	25.2697	27	20	30
1	1	125	450.265	468.54	113	1.37601	0.686912	11.9948	0.941667	0.807143	4363	38.6106	39	30	48
1	1	126	454.785	140.813	107	1.25762	0.60412	11.672	0.90678	0.748252	3888	16.3364	38	29	44
1	1	127	456.12	159.5	100	1.2749	0.620284	11.2838	0.925926	0.769231	3958	38.58	41	31	47
1	1	128	461.271	117.624	133	1.7004	0.808791	13.0131	0.875	0.59375	4162	31.2932	33	24	38
1	1	129	463.58	186.899	257	1.12078	0.810637	18.0893	0.911348	0.679894	9420	36.6537	38	28	46
1	1	130	472.762	297.525	101	1.12931	0.464354	11.3401	0.90991	0.765152	8080	80	79	63	98
1	1	131	477.607	138.476	145	1.23853	0.589992	13.5875	0.923567	0.739796	4309	29.7172	30	23	30
1	1	132	477.543	342.586	116	1.10393	0.433593	12.153	0.913386	0.74359	4237	36.5259	39	30	43
1	1	133	479.45	22.1551	109	1.42048	0.710199	11.7806	0.923729	0.778571	4270	39.1743	40	31	48
1	1	134	483.604	602.073	164	2.07652	0.874605	14.4503	0.916201	0.780952	5044	30.7561	33	25	37
1	1	135	480.397	166.905	63	1.41513	0.707584	8.9623	0.851351	0.63	5763	107.349	109	85	134
1	1	136	490.58	254.707	174	1.57576	0.766678	14.8843	0.83584	0.74359	5842	107.349	109	85	134
1	1	137	487.806	313.897	82	1.60841	0.818165	16.2137	0.822134	0.521193	3892	42.7803	43	31	47
1	1	138	496.029	331.5	208	2.09048	0.878165	16.2137	0.822134	0.521193	3892	42.7803	43	31	47
1	1	139	498.219	7.92708	96	1.10594	0.427089	11.0558	0.905566	0.727273	4280	41.3922	44	33	50
1	1	140	498.817	358.104	115	1.19899	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	141	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	142	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	143	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	144	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	145	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	146	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	147	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	148	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	149	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	150	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	151	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	152	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	153	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	154	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	155	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	156	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	157	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	158	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	159	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	160	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	161	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	162	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	163	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	164	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	165	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	166	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	167	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	168	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	169	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	170	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	171	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	172	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	173	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	174	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	175	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	176	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	177	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	178	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	179	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	180	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	181	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566	0.727273	4280	41.3922	44	33	50
1	1	182	501.108	502.892	93	1.00155	0.551714	12.1005	0.905566</						



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1	1	11.1154	387.587	104	1.42586	0.712837	11.5073	0.904348	0.755325	3955	38.0288	39	31	46
1	1	9.80303	429.712	66	1.2069	0.559891	9.167	0.88	0.733333	3059	46.3485	48	40	53
1	1	11.6584	443.818	77	1.17652	0.526846	9.40149	0.927711	0.77	3970	56.7143	58	46	68
1	1	18.4143	455.586	70	1.03328	0.251744	9.4407	0.866076	0.7	3970	56.7143	58	46	68
1	1	18.4143	455.586	114	1.26328	0.510824	12.0438	0.912	0.730769	3892	38.4	39	27	41
1	1	11.52012	472.356	100	1.32632	0.732156	11.2838	0.8484956	0.714286	3840	38.4	39	27	41
1	1	15.8452	499.143	140	1.34832	0.725354	13.5312	0.903325	0.63	12608	66.709	69	51	36
1	1	15.8452	499.143	189	1.35343	0.61685	15.5216	0.836522	0.53	12608	66.709	69	51	36
1	1	25.8148	430.905	159	1.27031	0.61685	15.5216	0.836522	0.53	12608	66.709	69	51	36
1	1	25.8148	430.905	114	1.27031	0.61685	15.5216	0.836522	0.53	12608	66.709	69	51	36
1	1	27.688	113.544	125	1.44333	0.721089	12.6157	0.905353	0.730769	4004	35.1228	37	28	44
1	1	27.688	113.544	133	1.23456	0.585642	13.0131	0.917441	0.738869	4208	37.186	40	28	44
1	1	27.9023	349.684	133	1.33116	0.660045	11.9948	0.903226	0.606811	5557	38.0619	37	29	44
1	1	28.6991	66.8407	113	1.80157	0.831803	15.7973	0.903226	0.606811	5557	38.0619	37	29	44
1	1	30.7857	380.439	196	1.07869	0.374947	13.4935	0.922581	0.785714	1427	28.4126	29	23	35
1	1	36.7762	311.455	143	1.38906	0.694066	12.9125	0.82623	0.757217	1427	28.4126	29	23	35
1	1	49.0119	37.619	252	1.10508	0.425606	12.4634	0.937063	0.782051	4662	38.2131	39	30	46
1	1	45.7623	203.731	134	1.60438	0.781987	13.0619	0.937063	0.782051	4662	38.2131	39	30	46
1	1	46.7836	123.731	134	1.49716	0.744624	15.4294	0.917749	0.69281	8804	41.5283	32	25	37
1	1	51.3043	461.739	92	1.44818	0.722855	10.823	0.910891	0.69687	3641	39.5761	39	31	49
1	1	50.717	68.5566	212	1.03578	0.260563	24.67	0.910476	0.735385	14880	31.1297	32	24	38
1	1	64.6333	121.808	120	1.21481	0.567792	12.3608	0.895522	0.710059	4070	33.9167	35	27	41
1	1	68.3001	270.181	221	1.5985	0.780155	16.7746	0.937063	0.782051	4662	38.2131	39	30	46
1	1	75.623	339.558	156	1.54808	0.763371	14.0935	0.923077	0.736667	7891	35.7059	37	28	44
1	1	64.7756	370.518	144	2.21108	0.893926	13.5406	0.947368	0.8	5206	36.1528	37	28	44
1	1	66.2917	50.0764	93	1.34339	0.662074	10.8817	0.902913	0.65035	3739	40.2043	41	33	49
1	1	67.2043	473	93	1.23867	0.590113	11.672	0.90678	0.748252	4231	28.7823	29	23	36
1	1	72.638	297.915	117	2.01167	0.867693	15.5126	0.917476	0.642857	5541	29.3175	30	23	36
1	1	72.582	401.974	189	1.70384	0.809651	13.0619	0.911565	0.679217	4152	30.9851	33	24	37
1	1	76.6716	134.731	134	1.23867	0.590113	11.672	0.90678	0.748252	4231	28.7823	29	23	36
1	1	74.6536	109.168	107	2.37263	0.906841	13.6809	0.90184	0.668182	4231	28.7823	29	23	36
1	1	85.2585	188.102	117	1.15561	0.513778	11.9948	0.904	0.724359	4168	36.885	38	29	46
1	1	91.8089	208.6	403	1.49429	0.743068	22.6521	0.846639	0.648953	14872	36.9032	37	28	45
1	1	90.5596	140.101	109	1.57451	0.772416	11.7806	0.834443	0.64881	4053	37.1835	39	30	45
1	1	98.5158	453.579	273	1.91669	0.853109	18.6439	0.877814	0.598684	13955	51.1172	52	38	64
1	1	99.1137	247.893	289	1.62483	0.788176	19.5115	0.917304	0.684211	9570	32.0067	33	25	39
1	1	98.7144	155.452	277	2.98601	0.942255	18.7817	0.882166	0.502722	7730	27.9061	29	21	34
1	1	98.7144	155.452	277	1.67096	0.801153	10.8817	0.885714	0.65035	3856	41.4624	42	32	50
1	1	108.312	493.449	205	2.13682	0.884376	16.1559	0.911111	0.711806	4828	22.5756	23	17	28
1	1	112.42	222.761	117	1.82283	0.784417	13.8198	0.931677	0.757576	7793	51.9533	53	40	64
1	1	111.812	445.444	150	1.39604	0.58826	13.7316	0.936977	0.764706	4458	38.1026	39	31	45
1	1	113.866	346.631	149	1.37994	0.63137	11.6174	0.923825	0.815385	3923	37.0094	37	29	45
1	1	120.83	411.358	106	1.15603	0.50172	10.3418	0.834237	0.644215	2693	32.0585	33	25	38
1	1	129.329	192.143	84	1.85997	0.845956	17.9125	0.932749	0.680604	1477	21.1175	28	21	34
1	1	137.19	454.365	252	2.06323	0.874693	19.7063	0.918675	0.680604	1477	21.1175	28	21	34
1	1	134.843	128.974	305	1.50812	0.748552	20.1535	0.932749	0.680604	1477	21.1175	28	21	34
1	1	141.141	215.84	319	1.33313	0.661311	12.3092	0.915385	0.772727	3864	41.4589	44	32	50
1	1	137.059	242.798	119	1.77589	0.82639	16.2345	0.924107	0.704062	8962	41.4589	44	32	50
1	1	145.367	17.8986	207	1.65246	0.796105	12.1005	0.927419	0.680473	4040	35.1304	37	28	42
1	1	153.278	413.183	115	1.06378	0.341056	13.159	0.937931	0.747253	4230	31.1029	33	25	37
1	1	159.706	91.2327	245	2.00944	0.867317	17.6619	0.924528	0.753846	8913	36.3796	37	28	44
1	1	159.59	393.024	83	1.4086	0.70428	10.28	0.912088	0.691667	3838	46.241	47	37	57
1	1	164.983	500.36	175	1.69183	0.806617	14.9271	0.91623	0.643382	4480	25.6	26	20	31
1	1	170.853	257.131	375	1.34636	0.665575	21.851	0.910194	0.708885	14547	38.792	39	31	48
1	1	177.162	54.2575	167	1.52019	0.753181	14.5819	0.912568	0.701681	5095	30.509	32	24	36
1	1	178.6	387.358	95	1.20724	0.560236	10.9881	0.896226	0.719697	3826	40.2737	40	32	49
1	1	182.152	435.777	224	2.7007	0.928922	16.888	0.858238	0.518519	9007	40.2098	40	31	51
1	1	179.327	459.119	101	1.22641	0.578918	11.3401	0.926606	0.765152	4011	39.7129	41	33	48
1	1	183.359	190.781	128	1.23747	0.589043	12.7662	0.948148	0.820513	2772	21.6563	22	17	26
1	1	185.464	503.145	110	1.86455	0.844013	11.8345	0.887097	0.604396	4156	37.7818	39	29	47
1	1	197.076	139.323	223	1.63285	0.790527	16.8503	0.940328	0.724026	8777	39.3587	39	30	50
1	1	194.681	214.072	138	2.23437	0.894257	12.2555	0.907895	0.766667	4036	29.2464	30	22	36
1	1	194.681	214.072	138	1.71204	0.811682	11.9948	0.91129	0.684848	4036	35.7168	36	27	44
1	1	199.681	455.08	113	1.92002	0.855302	16.9633	0.896825	0.724359	7754	34.3097	36	27	44
1	1	207.119	282.204	226	1.26158	0.608669	12.2053	0.92126	0.75974	3975	33.9744	35	26	42
1	1	203.444	259.208	178	1.36462	0.804137	15.0945	0.92228	0.706349	6679	37.5225	39	30	46
1	1	210.406	15.8125	128	1.45902	0.728114	12.7662	0.901408	0.711111	4017	31.3828	32	24	39
1	1	220.184	93.6399	461	1.13472	0.472359	24.2773	0.931313	0.770903	18442	40.0043	42	30	50
1	1	225.178	214.767	163	1.11492	0.44218	14.4062	0.926136	0.724444	4374	26.8344	28	21	32
1	1	230.979	235.904	146	1.31912	0.65216	13.6343	0.918239	0.695238	4134	28.3151	29	22	35
1	1	236.673	495.272	346	2.33131	0.903331	20.9891	0.800926	0.518741	10802	31.2197	33	23	39
1	1	235.402	132.659	255	1.7484	0.820288	18.0188	0.897887	0.643939	8918	34.9125	36	27	44
1	1	231.124	391.719	89	1.45186	0.724978	10.6451	0.89899	0.760684	4314	48.4719	47	38	59
1	1	242.741	156.606	251	2.26019	0.896797	17.8769	0.820261	0.603365	9132	36.3825	38	28	45
1	1	239.34	189.296	162	1.7497	0.820584	14.3619	0.89011	0.692308	4184	25.8272	26	20	31
1	1	238.514	24.8551	138	1.77073	0.825269	13.2555	0.92	0.657143	4080	29.5652	30	23	36

77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
241.36	241.46	241.56	241.66	241.76	241.86	241.96	242.06	242.16	242.26	242.36	242.46	242.56	242.66	242.76	242.86	242.96	243.06	243.16	243.26	243.36	243.46	243.56	243.66	243.76	243.86	243.96	244.06	244.16	244.26	244.36	244.46	244.56	244.66	244.76	244.86	244.96	245.06	245.16	245.26	245.36	245.46	245.56	245.66	245.76	245.86	245.96	246.06	246.16	246.26	246.36	246.46	246.56	246.66	246.76	246.86	246.96	247.06	247.16	247.26	247.36	247.46	247.56	247.66	247.76	247.86	247.96	248.06	248.16	248.26	248.36	248.46	248.56	248.66	248.76	248.86	248.96	249.06	249.16	249.26	249.36	249.46	249.56	249.66	249.76	249.86	249.96	250.06	250.16	250.26	250.36	250.46	250.56	250.66	250.76	250.86	250.96	251.06	251.16	251.26	251.36	251.46	251.56	251.66	251.76	251.86	251.96	252.06	252.16	252.26	252.36	252.46	252.56	252.66	252.76	252.86	252.96	253.06	253.16	253.26	253.36	253.46	253.56	253.66	253.76	253.86	253.96	254.06	254.16	254.26	254.36	254.46	254.56	254.66	254.76	254.86	254.96	255.06	255.16	255.26	255.36	255.46	255.56	255.66	255.76	255.86	255.96	256.06	256.16	256.26	256.36	256.46	256.56	256.66	256.76	256.86	256.96	257.06	257.16	257.26	257.36	257.46	257.56	257.66	257.76	257.86	257.96	258.06	258.16	258.26	258.36	258.46	258.56	258.66	258.76	258.86	258.96	259.06	259.16	259.26	259.36	259.46	259.56	259.66	259.76	259.86	259.96	260.06	260.16	260.26	260.36	260.46	260.56	260.66	260.76	260.86	260.96	261.06	261.16	261.26	261.36	261.46	261.56	261.66	261.76	261.86	261.96	262.06	262.16	262.26	262.36	262.46	262.56	262.66	262.76	262.86	262.96	263.06	263.16	263.26	263.36	263.46	263.56	263.66	263.76	263.86	263.96	264.06	264.16	264.26	264.36	264.46	264.56	264.66	264.76	264.86	264.96	265.06	265.16	265.26	265.36	265.46	265.56	265.66	265.76	265.86	265.96	266.06	266.16	266.26	266.36	266.46	266.56	266.66	266.76	266.86	266.96	267.06	267.16	267.26	267.36	267.46	267.56	267.66	267.76	267.86	267.96	268.06	268.16	268.26	268.36	268.46	268.56	268.66	268.76	268.86	268.96	269.06	269.16	269.26	269.36	269.46	269.56	269.66	269.76	269.86	269.96	270.06	270.16	270.26	270.36	270.46	270.56	270.66	270.76	270.86	270.96	271.06	271.16	271.26	271.36	271.46	271.56	271.66	271.76	271.86	271.96	272.06	272.16	272.26	272.36	272.46	272.56	272.66	272.76	272.86	272.96	273.06	273.16	273.26	273.36	273.46	273.56	273.66	273.76	273.86	273.96	274.06	274.16	274.26	274.36	274.46	274.56	274.66	274.76	274.86	274.96	275.06	275.16	275.26	275.36	275.46	275.56	275.66	275.76	275.86	275.96	276.06	276.16	276.26	276.36	276.46	276.56	276.66	276.76	276.86	276.96	277.06	277.16	277.26	277.36	277.46	277.56	277.66	277.76	277.86	277.96	278.06	278.16	278.26	278.36	278.46	278.56	278.66	278.76	278.86	278.96	279.06	279.16	279.26	279.36	279.46	279.56	279.66	279.76	279.86	279.96	280.06	280.16	280.26	280.36	280.46	280.56	280.66	280.76	280.86	280.96	281.06	281.16	281.26	281.36	281.46	281.56	281.66	281.76	281.86	281.96	282.06	282.16	282.26	282.36	282.46	282.56	282.66	282.76	282.86	282.96	283.06	283.16	283.26	283.36	283.46	283.56	283.66	283.76	283.86	283.96	284.06	284.16	284.26	284.36	284.46	284.56	284.66	284.76	284.86	284.96	285.06	285.16	285.26	285.36	285.46	285.56	285.66	285.76	285.86	285.96	286.06	286.16	286.26	286.36	286.46	286.56	286.66	286.76	286.86	286.96	287.06	287.16	287.26	287.36	287.46	287.56	287.66	287.76	287.86	287.96	288.06	288.16	288.26	288.36	288.46	288.56	288.66	288.76	288.86	288.96	289.06	289.16	289.26	289.36	289.46	289.56	289.66	289.76	289.86	289.96	290.06	290.16	290.26	290.36	290.46	290.56	290.66	290.76	290.86	290.96	291.06	291.16	291.26	291.36	291.46	291.56	291.66	291.76	291.86	291.96	292.06	292.16	292.26	292.36	292.46	292.56	292.66	292.76	292.86	292.96	293.06	293.16	293.26	293.36	293.46	293.56	293.66	293.76	293.86	293.96	294.06	294.16	294.26	294.36	294.46	294.56	294.66	294.76	294.86	294.96	295.06	295.16	295.26	295.36	295.46	295.56	295.66	295.76	295.86	295.96	296.06	296.16	296.26	296.36	296.46	296.56	296.66	296.76	296.86	296.96	297.06	297.16	297.26	297.36	297.46	297.56	297.66	297.76	297.86	297.96	298.06	298.16	298.26	298.36	298.46	298.56	298.66	298.76	298.86	298.96	299.06	299.16	299.26	299.36	299.46	299.56	299.66	299.76	299.86	299.96	300.06	300.16	300.26	300.36	300.46	300.56	300.66	300.76	300.86	300.96	301.06	301.16	301.26	301.36	301.46	301.56	301.66	301.76	301.86	301.96	302.06	302.16	302.26	302.36	302.46	302.56	302.66	302.76	302.86	302.96	303.06	303.16	303.26	303.36	303.46	303.56	303.66	303.76	303.86	303.96	304.06	304.16	304.26	304.36	304.46	304.56	304.66	304.76	304.86	304.96	305.06	305.16	305.26	305.36	305.46	305.56	305.66	305.76	305.86	305.96	306.06	306.16	306.26	306.36	306.46	306.56	306.66	306.76	306.86	306.96	307.06	307.16	307.26	307.36	307.46	307.56	307.66	307.76	307.86	307.96	308.06	308.16	308.26	308.36	308.46	308.56	308.66	308.76	308.86	308.96	309.06	309.16	309.26	309.36	309.46	309.56	309.66	309.76	309.86	309.96	310.06	310.16	310.26	310.36	310.46	310.56	310.66	310.76	310.86	310.96	311.06	311.16	311.26	311.36	311.46	311.56	311.66	311.76	311.86	311.96	312.06	312.16	312.26	312.36	312.46	312.56	312.66	312.76	312.86	312.96	313.06	313.16	313.26	313.36	313.46	313.56	313.66	313.76	313.86	313.96	314.06	314.16	314.26	314.36	314.46	314.56	314.66	314.76	314.86	314.96	315.06	315.16	315.26	315.36	315.46	315.56	315.66	315.76	315.86	315.96	316.06	316.16	316.26	316.36	316.46	316.56	316.66	316.76	316.86	316.96	317.06	317.16	317.26	317.36	317.46	317.56	317.66	317.76	317.86	317.96	318.06	318.16	318.26	318.36	318.46	318.56	318.66	318.76	318.86	318.96	319.06	319.16	319.26	319.36	319.46	319.56	319.66	319.76	319.86	319.96	320.06	320.16	320.26	320.36	320.46	320.56	320.66	320.76	320.86	320.96	321.06	321.16	321.26	321.36	321.46	321.56	321.66	321.76	321.86	321.96	322.06	322.16	322.26	322.36	322.46	322.56	322.66	322.76	322.86	322.96	323.06	323.16	323.26	323.36	323.46	323.56	323.66	323.76	323.86	323.96	324.06	324.16	324.26	324.36	324.46	324.56	324.66	324.76	324.86	324.96	325.06	325.16	325.26	325.36	325.46	325.56	325.66	325.76	325.86	325.96	326.06	326.16	326.26	326.36	326.46	326.56	326.66	326.76	326.86	326.96	327.06	327.16	327.26	327.36	327.46	327.56	327.66	327.76	327.86	327.96	328.06	328.16	328.26	328.36	328.46	328.56	328.66	328.76	328.86	328.96	329.06	329.16	329.26	329.36	329.46	329.56	329.66	329.76	329.86	329.96	330.06	330.16	330.26	330.36	330.46	330.56	330.66	330.76	330.86	330.96	331.06	331.16	331.26	331.36	331.46	331.56	331.66	331.76	331.86	331.96	332.06	332.16	332.26	332.36	332.46	332.56	332.66	332.76	332.86	332.96	333.06	333.16	333.26	333.36	333.46	333.56	333.66	333.76	333.86	333.96	334.06	334.16	334.26	334.36	334.46	334.56	334.66	334.76	334.86	334.96	335.06	335.16	335.26	335.36	335.46	335.56	335.66	335.76	335.86	335.96	336.06	336.16	336.26	336.36	336.46	336.56	336.66	336.76	336.86	336.96	337.06	337.16	337.26	337.36	337.46	337.56	337.66	337.76	337.86	337.96	338.06	338.16	338.26	338.36	338.46	338.56	338.66	338.76	338.86	338.96	339.06	339.16	339.26	339.36	339.46	339.56	339.66	339.76	339.86	339.96	340.06	340.16	340.26	340.36	340.46	340.56	340.66	340.76	340.86	340.96	341.06	341.16	341.26	341.36	341.46	341.56	341.66	341.76	341.86	341.96	342.06	342.16	342.26	342.36	342.46	342.56	342.66	342.76	342.86	342.96	343.06	343.16	343.26	343.36	343.46	343.56	343.66	343.76	343.86	343.96	344.06	344.16	344.26	344.36	344.46	344.56	344.66	344.76	344.86	344.96

1	21.2188	364.125	64	1.29361	0.634372	0.902703	0.876712	0.727273	3642	56.9063	57	44	68
2	24.0233	483.946	129	1.82566	0.837231	12.8159	0.921429	0.661538	3872	30.0155	30	23	37
3	25.8429	514.293	140	1.45761	0.72755	13.3512	0.909091	0.729167	4313	30.8071	31	23	38
4	35.8429	231.374	208	1.8479	0.79483	16.1953	0.919643	0.677632	9014	43.7573	45	35	53
5	38.3262	328.643	178	1.06005	0.731795	15.0545	0.927063	0.791111	9196	51.6629	52	38	64
6	39.3667	41.52	130	1.17673	0.527089	13.8198	0.920245	0.765306	4709	31.3933	33	25	38
7	39.3667	362.398	85	1.17688	0.527265	10.4031	0.894737	0.708333	3980	46.8235	49	39	57
8	45.223	24.1727	139	1.77145	0.702172	13.3034	0.958621	0.842424	4279	30.7842	32	25	36
9	57.3316	101.988	187	1.77145	0.823428	13.3034	0.932195	0.67857	4410	23.5829	24	18	29
10	55.8904	62.5274	146	1.61579	0.785473	13.8343	0.932195	0.67857	4410	23.5829	24	18	29
11	55.8904	126.373	126	1.31697	0.650718	12.666	0.9	0.623403	4298	29.4384	30	22	36
12	65.4198	170.966	324	2.47752	0.914923	20.3108	0.79803	0.623403	4298	29.4384	30	22	36
13	61.8615	292.138	195	1.65239	0.798039	15.757	0.919811	0.623403	4298	29.4384	30	22	36
14	63.3444	241.022	180	1.7726	0.825678	15.1388	0.904523	0.714286	5025	48.5	50	31	59
15	73.2232	375.178	45	1.42858	0.714145	7.5694	0.918367	0.714286	3366	74.8	74	56	94
16	77.3137	327.052	153	1.46509	0.730839	13.9573	0.921687	0.75	4472	29.2288	30	24	35
17	77.3137	362.453	53	1.14916	0.492694	8.21472	0.913793	0.736111	3514	45.8594	47	37	54
18	83.9479	94.3646	192	1.27679	0.621756	15.6353	0.923077	0.761905	8895	35.2	36	27	43
19	96.0609	317.826	115	1.25503	0.804248	12.1005	0.912698	0.747533	4088	46.9036	48	36	59
20	98.0964	190.528	197	1.14488	0.486908	15.8376	0.920561	0.742653	9240	39.8835	41	31	49
21	96.6796	467.951	103	1.32942	0.658926	11.4518	0.895652	0.72028	4108	43.0443	42	31	53
22	102.453	121.97	203	2.8942	0.938412	16.0769	0.835391	0.461364	8738	32.1311	33	26	39
23	102.453	121.97	203	1.72624	0.815118	12.4634	0.917293	0.622449	3920	29.1879	30	22	35
24	100.951	38.6639	122	1.68847	0.844726	13.7736	0.925466	0.622222	4349	33.9308	35	27	41
25	101.027	99.9591	149	1.17019	0.519347	11.8655	0.902778	0.714286	4411	38.5229	39	30	46
26	104.422	439.385	130	1.30509	0.50664	15.9177	0.929907	0.756944	4199	44.7588	47	34	54
27	109.131	54.3367	199	1.22263	0.642565	10.7047	0.918367	0.692308	3953	43.9222	45	35	53
28	116.914	98.9871	81	1.22263	0.575349	12.1005	0.912698	0.746753	4134	35.9478	37	28	44
29	116.914	98.9871	81	1.22263	0.575349	12.1005	0.912698	0.746753	4134	35.9478	37	28	44
30	123.33	294.65	200	1.59791	0.778969	15.9577	0.899083	0.742424	3924	40.0408	41	33	48
31	123.33	294.65	200	1.59791	0.778969	15.9577	0.899083	0.742424	3924	40.0408	41	33	48
32	127.437	444.757	103	1.17163	0.630508	11.2272	0.9	0.714286	9236	46.18	47	35	58
33	132.758	195.931	271	1.65132	0.735144	18.78	0.923333	0.70844	9756	42.0808	42	33	51
34	132.758	195.931	271	1.65132	0.735144	18.78	0.923333	0.70844	9756	42.0808	42	33	51
35	139.467	254.46	197	1.82919	0.837336	15.4304	0.916667	0.67857	9071	35.2202	37	26	43
36	141.877	452.56	106	1.45378	0.72484	11.6174	0.929825	0.741259	4167	48.508	50	37	61
37	141.877	452.56	106	1.45378	0.72484	11.6174	0.929825	0.741259	4167	48.508	50	37	61
38	146.702	221.56	84	1.35937	0.697744	10.3018	0.903926	0.717778	4112	48.9524	49	36	61
39	161.276	449.352	105	1.21735	0.570307	11.5624	0.898305	0.741259	4275	39.3113	40	31	48
40	171.014	329.937	284	1.38269	0.696111	11.5624	0.913043	0.68181	4157	48.9524	49	36	61
41	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
42	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
43	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
44	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
45	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
46	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
47	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
48	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
49	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
50	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
51	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
52	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
53	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
54	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
55	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
56	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
57	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
58	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
59	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
60	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
61	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
62	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
63	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
64	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
65	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
66	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
67	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
68	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
69	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
70	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
71	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
72	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
73	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
74	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
75	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
76	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
77	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
78	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
79	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
80	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
81	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48
82	165.614	211.861	101	2.56996	0.94161	15.0158	0.850282	0.473333	13145	39.5905	41	32	48

EV Table 1.doc

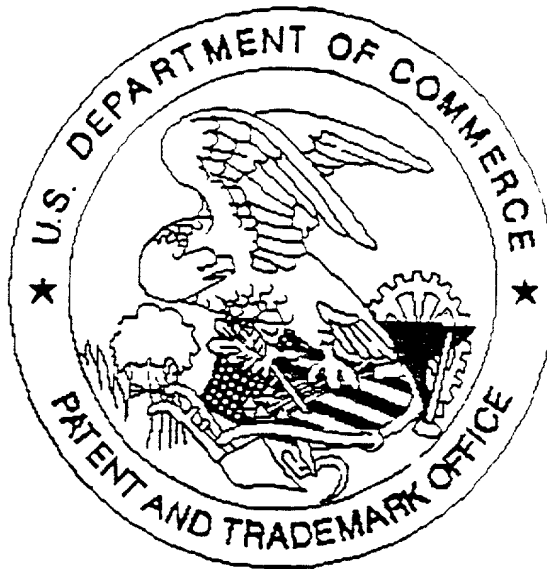
1	1	83	283.646	101.811	127	1.6886	0.805787	12.7162	0.913669	0.661458	4625	36.4173	37	29	44
1	1	84	284.665	240.917	173	1.53854	0.759964	14.8415	0.925134	0.758772	7670	44.3353	46	35	54
1	1	85	285.684	429.917	84	1.53454	0.758911	10.3418	0.903226	0.646154	4211	50.131	51	39	62
1	1	86	286.312	80.4481	154	1.13337	0.470646	14.0028	0.916667	0.713333	4526	29.3896	30	23	36
1	1	87	287.339	305.311	90	1.08786	0.397174	10.7587	0.909091	0.743802	4134	45.9333	46	36	56
1	1	88	288.364	47.3246	107	1.37271	0.685058	11.672	0.69916	0.764286	4067	38.0093	39	29	46
1	1	89	300.374	32.735	106	1.51544	0.758839	11.6174	0.938053	0.84127	4700	44.3396	44	36	54
1	1	90	302.5	346.784	148	2.3895	0.908083	11.7213	0.840309	0.528571	6947	60.4527	60	41	74
1	1	91	303.561	364.341	44	2.3895	0.908083	11.7213	0.840309	0.528571	6947	60.4527	60	41	74
1	1	92	305.155	364.341	44	2.3895	0.908083	11.7213	0.840309	0.528571	6947	60.4527	60	41	74
1	1	93	312.337	242.253	359	2.03863	0.874094	16.888	0.914286	0.59893	9246	41.2768	43	32	50
1	1	94	312.337	242.253	359	2.03863	0.874094	16.888	0.914286	0.59893	9246	41.2768	43	32	50
1	1	95	315.082	322.148	182	1.48417	0.738934	15.2227	0.928571	0.738934	4968	31.5656	33	25	38
1	1	96	322.65	51.4724	163	1.82878	0.835902	14.4062	0.928571	0.738934	4968	31.5656	33	25	38
1	1	97	327.5	256.405	158	1.82878	0.835902	14.4062	0.928571	0.738934	4968	31.5656	33	25	38
1	1	98	332.743	422.568	241	1.64439	0.793838	17.5172	0.895911	0.634211	5916	48.1482	42	31	51
1	1	99	342.921	46.3444	151	1.33418	0.661977	13.8658	0.920732	0.725962	4249	28.1391	29	22	34
1	1	100	342.921	46.3444	151	1.33418	0.661977	13.8658	0.920732	0.725962	4249	28.1391	29	22	34
1	1	101	344.143	139.607	28	1.60966	0.806686	5.97082	0.875	0.666667	5659	202.107	213	166	238
1	1	102	352.064	283.676	173	1.60966	0.806686	5.97082	0.875	0.666667	5659	202.107	213	166	238
1	1	103	352.064	283.676	173	1.60966	0.806686	5.97082	0.875	0.666667	5659	202.107	213	166	238
1	1	104	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	105	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	106	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	107	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	108	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	109	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	110	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	111	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	112	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	113	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	114	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	115	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	116	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	117	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	118	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	119	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	120	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	121	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	122	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	123	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	124	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	125	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	126	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	127	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	128	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	129	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	130	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	131	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	132	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	133	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	134	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	135	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	136	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69
1	1	137	358.12	396.634	145	1.37417	0.685884	11.5875	0.929487	0.74359	8423	58.0897	60	47	69

THE UNIVERSITY OF CHICAGO

**Example of the summary output of AnalyseDNA.m program  
(summary for 10 3 by 3 montage images)**

1	1187	163.912	79.3918	1.59849	0.398735	0.726461	0.137986	14.0612	3.315	0.905327	0.0350365	0.701248	0.075176	6449.26	3496.95	41.539	18.352	42.9444	18.9393
	32.4103	14.334	50.5906	22.6584	0.399942	0.727835	0.139462	14.2634	3.43288	0.906571	0.0341453	0.701777	0.0730289	6786.37	3895.1	42.2416	17.0965	43.8245	17.583
2	1305	169.034	86.9722	1.60511	0.399942	0.727835	0.139462	14.2634	3.43288	0.906571	0.0341453	0.701777	0.0730289	6786.37	3895.1	42.2416	17.0965	43.8245	17.583
	33.0245	13.3382	51.3609	21.2507	0.397935	0.72552	0.13163	14.0853	3.33904	0.905267	0.0361822	0.702891	0.0720005	6881.08	3525.81	44.7167	20.5918	46.3838	21.2287
3	1399	164.57	80.0679	1.58728	0.397935	0.72552	0.13163	14.0853	3.33904	0.905267	0.0361822	0.702891	0.0720005	6881.08	3525.81	44.7167	20.5918	46.3838	21.2287
	34.8313	16.2062	54.4417	25.1765	0.389882	0.727142	0.142518	14.3531	3.61812	0.902766	0.0374254	0.695945	0.0753889	6997.68	4212.87	43.1798	19.8582	44.9561	20.5112
4	1388	172.075	89.7145	1.60189	0.389882	0.727142	0.142518	14.3531	3.61812	0.902766	0.0374254	0.695945	0.0753889	6997.68	4212.87	43.1798	19.8582	44.9561	20.5112
	33.7349	15.9902	52.505	24.193	0.400493	0.721084	0.141204	14.338	3.65065	0.904132	0.0379804	0.70023	0.0756884	7050.22	4163.04	44.0559	21.4761	45.8522	22.1282
5	1448	171.921	90.64	1.58887	0.400493	0.721084	0.141204	14.338	3.65065	0.904132	0.0379804	0.70023	0.0756884	7050.22	4163.04	44.0559	21.4761	45.8522	22.1282
	34.3315	16.6358	53.6367	26.5398	0.425512	0.728414	0.133721	14.0974	3.39686	0.904614	0.0362731	0.696204	0.0782855	6843.2	3924.12	44.266	19.3396	45.9485	19.8324
6	1418	165.142	84.6806	1.60342	0.425512	0.728414	0.133721	14.0974	3.39686	0.904614	0.0362731	0.696204	0.0782855	6843.2	3924.12	44.266	19.3396	45.9485	19.8324
	34.5444	15.2864	53.9055	23.8472	0.451022	0.694813	0.185667	11.728	5.27441	0.893311	0.0481729	0.704526	0.0892393	5162.51	4393.11	34.9743	21.1969	36.16	22.0024
7	1756	129.864	99.2039	1.57806	0.451022	0.694813	0.185667	11.728	5.27441	0.893311	0.0481729	0.704526	0.0892393	5162.51	4393.11	34.9743	21.1969	36.16	22.0024
	26.8901	17.0421	43.0689	25.6082	0.405467	0.723421	0.137599	14.3833	3.40593	0.906384	0.0357179	0.702574	0.0751602	6865.87	3767.48	42.2752	17.2223	43.9781	17.7621
8	1280	171.587	84.1254	1.59301	0.405467	0.723421	0.137599	14.3833	3.40593	0.906384	0.0357179	0.702574	0.0751602	6865.87	3767.48	42.2752	17.2223	43.9781	17.7621
	33.0602	13.7194	51.3961	20.956	0.404986	0.72668	0.136548	14.1402	3.47794	0.905208	0.0356298	0.700331	0.0766773	6576.54	4022.38	41.6064	17.8994	43.163	18.2499
9	1270	166.33	86.5094	1.60367	0.404986	0.72668	0.136548	14.1402	3.47794	0.905208	0.0356298	0.700331	0.0766773	6576.54	4022.38	41.6064	17.8994	43.163	18.2499
	32.3669	13.8149	50.6976	22.2407	0.400372	0.717147	0.139095	13.8205	3.49536	0.904275	0.0379111	0.702759	0.07572	6587.18	3788.39	44.2141	20.7694	45.8765	21.136
10	1425	159.606	83.618	1.57886	0.400372	0.717147	0.139095	13.8205	3.49536	0.904275	0.0379111	0.702759	0.07572	6587.18	3788.39	44.2141	20.7694	45.8765	21.136
	34.4582	16.3199	53.7958	25.6094															

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